1131

No. 3081

United States Circuit Court of Appeals

1131

For the Ninth Circuit

MINERALS SEPARATION, LTD., ET AL,

Appellees,

vs.

BUTTE & SUPERIOR MINING COMPANY,

Appellant.

Transcript of Record

Volume 9---EXHIBITS

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UPON APPEAL FROM THE UNITED STATES DISTRICT COURT FOR THE DISTRICT OF MONTANA

McKee Ptg. Co., Butte, Mont.

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Plaintiff's Exhibit 1.

THIS AGREEMENT, made and entered into this 22nd day of July, 1911, by and between the Butte & Superior Copper Company, Limited, a corporation created and operating under and by virtue of the laws of Arizona, and doing business in Montana, party of the first part, and J. M. Hyde, party of the second part;

WITNESSETH: WHEREAS, James M. Hyde claims that he has knowledge of a method of treating certain ores of the character of the ore produced in the BLACK ROCK MINE, the property of the Butte & Superior Copper Company, Limited, by means of a process known as "The Gas Bubble Flotation Process," and whereas the said Hyde represents that in his best judgment an increased saving in the milling of said ores being treated by the Butte & Superior Copper Company, Limited, at the mill operated by the said Butte and Superior Copper Company, Limited, at Basin, may be made by the use of said process, and, WHEREAS, The Butte and Superior Copper Company, Limited, is desirous of testing the efficiency of the said process with a view of ascertaining whether or not the use of the said process will increase the saving of values at its said mill;

NOW THEREFORE, for and in consideration of the mutual promises and agreements of the parties hereto and the covenants, and agreements hereinafter contained, the parties hereto do hereby agree as follows, to-wit:

Plaintiff's Exhibit 1.

The said Company agrees that it will furnish a sum not to exceed Twenty-Five Hundred ($2500.00) Dollars to be used by the said Hyde in the equipment and installation of a fifty (50) ton experimental plant for the use of the said flotation process at Basin, Montana, the said plant to be erected under the supervision of the said Hyde, he to have full charge of the erection of said experimental plant provided, however, that in the construction and operation of the said experimental plant the running of the mill now operated by the Butte and Superior Copper Company, Limited, shall in nowise be interfered with.

The said Company further agrees that the said Hyde may engage his own assistants for the operation of the said experimental plant provided that the payroll of the men employed by the said Hyde in the operation of the said experimental plant shall not exceed Forty ($40.00) Dollars per day, and the said Company agrees that it will pay the said payroll provided the sum does not exceed Forty ($40.00) Dollars per day. It is expressly agreed and understood that the said Hyde shall receive no sum whatsoever as compensation either for the construction or operation of the said experimental plant save and except his personal expenses while engaged in mill work in the said Company's behalf, said sum not to exceed Five ($5.00) Dollars per day.

It is further agreed and understood by the said Hyde that said experimental plant shall be operated

Plaintiff's Exhibit 1.

for a period of thirty (30) days after its completion, the said process above referred to to be used exclusively in the operation of said experimental plant and that if in the judgment of the General Manager or Superintendent of the Butte and Superior Copper Company, Limited, the plant has not shown that the process used can increase the profits of said Company by at least twenty-five (25c) per ton on each ton of ore treated, the Company may at its option declare this agreement null and void and of no force or effect and neither party hereto shall have any further right or claim under this agreement.

It is further agreed that if in the judgment of said Hyde at the expiration of said thirty (30) days test work in the experimental plant, it does not appear that the process can be used by the Company to enough profit to insure him a sufficient compensation to warrant him in giving further time to the business, he may declare this agreement null and void and of no effect after he has instructed an agent of the Company thoroughly in the details of the process and has released the Company from all further financial obligation to him other than the payment of his expense account as herein provided.

It is further agreed and understood that if the treatment of ore in the said experimental plant has not indicated that the process can be operated to the financial benefit of the said Company the said Company shall so declare to the said Hyde and this agreement shall be null and void and neither party hereto will have any right or claim hereunder.

Plaintiff's Exhibit 1.

It is further agreed, however, that if in the judgment of the General Manager or Superintendent of the said Company, the said process is adaptable to the profitable treatment of the ore mined at the Butte and Superior Copper Company, Limited, mines at Butte, Montana, and that by use thereof a sufficient financial saving can be made by the said Company to justify the adoption of the use of the said process, the Company will immediately furnish funds for the purpose of installing a plant sufficient in size to treat all of the ore not recovered as jig concentrates in the present plant operated by the said Company at Basin, Montana, when the mill is treating 400 dry tons per day, provided, however, that the total cost of said last mentioned plant shall not exceed ten thousand ($10,000.00) Dollars.

The said Hyde agrees to furnish plans for the erection and construction of said last mentioned plant and further agrees to personally supervise the erection and construction of the said plant, and the said Hyde further agrees that he will make no charge whatsoever for his services in this connection save and except as hereinafter provided for and the said Hyde further agrees that after the completion of said last mentioned plant, he will supervise its operation in the use of the "Gas Bubble Flotation" process for a period of at least ninety (90) days and that during said period he will fully instruct an agent of the said Company in the operation of the said plant so thoroughly that the said agent of the said Company will be able to operate

Plaintiff's Exhibit 1.

the said plant without the assistance of the said Hyde, provided, however, that the said Hyde shall not be obliged to devote more of his time to the personal supervision of the plant than in the judgment of the General Manager or Superintendent of the said Company is necessary to its successful operation or for the complete instruction of the said Company's agent. It is agreed and understood that during the erection of the last mentioned plant and during the operation of same the employees of the said Company may have full and complete access thereto, but that during the erection and the operation of the experimental plant the said Hyde shall have the right to exclude any and all persons from the building in which the said experimental plant is being constructed or operated.

It is agreed and understood that the said Hyde shall receive as full remuneration and compensation for all services rendered (excepting personal expense account as herein provided) a sum equal to one and two-thirds of every dollar of increased profit which shall accrue to the said Company through the operation of the said larger plant during any continuous period of thirty days which the said Hyde may select within the first ninety days that the said plant is operating after its final completion and during which the grade of ore treated has not averaged over twenty-one (21%) per cent. zinc nor less than eighteen and one-half (18½%) per cent. zinc and the tonnage treated has been at least twelve thousand (12,000) dry tons during said period of thirty (30) days, it being understood and agreed that the said Hyde shall receive no further remuneration or compensation from the said Company save and except the said compensation to be paid ~~this~~ said Hyde on the increased profits which have accrued to the Company during the said period of thirty (30) days so selected by the said Hyde.

It is especially agreed and understood that the basis of the increased profits of the said Company in the operation of the said entire plant, upon which increased compensation of the said Hyde shall be based, shall be determined by comparing the profits of the operation of the entire completed plant, including the said flotation plant, with the operation of the said concentrating plant, in the following manner, to-wit:

1. The net smelter returns for the product made during the thirty days so selected by the said Hyde during which time his compensation shall be estimated, shall be calculated on the basis of $5.20 per hundred weight, as the market price of spelter, f. o. b. cars St. Louis, Mo.

2. The milling cost of the concentrating plant as operated before the installation of the flotation equipment shall be assumed to be one dollar and fifty-one ($1.51) cents per dry ton of ore treated.

3. The recovery of the concentrator plant as operated before the installation of the flotation equipment shall be assumed to be seventy (70%) per cent. with the proportion and grades of concentrates, as follows, to-wit:

82% of zinc recovered as concentrate containing 50.8% zinc, no penalty.

Plaintiff's Exhibit 1.

5% of zinc recovered as concentrate containing 50.4% zinc, 50 cent screen penalty only.

13% of zinc recovered as concentrate containing 45.0% zinc, 50 cent screen penalty only.

4. In arriving at what shall constitute a dry ton of ore it is agreed that 2.6% of the railway weight shall be deducted from the ore treated during the said thirty days period.

5. From the sum of the calculated net smelter returns of the concentrating plant after the flotation process has been installed shall be subtracted the total cost of milling all ores in the Basin plant including the flotation plant, the result thereof being a sum herein designated as "Total Results".

6. From the calculated net smelter returns on the same amount and equal grade of ore as treated during the said 30 days on the basis of a seventy per cent. recovery with values as stated in paragraph No. 3, shall be subtracted the total calculated cost of milling in the concentrating plant at Basin, exclusive of the flotation plant installed by the said Hyde, at the rate of $1.51 per ton of dry ore treated, the result thereof being a sum herein designated as "Present Results."

7. The said Hyde shall receive as full compensation for his services hereunder a sum equal to one and two-thirds of the amount represented by subtracting the sum herein referred to as "Present Results" from the sum herein referred to as "Total Results", that is to say, if the sum represented as "Total Results" should be $100.00 and the sum represented as "Present Re-

sults" should be $60.00, the said Hyde shall receive as his full compensation one and two thirds times $40.00, equal in amount Sixty-six and two-thirds ($66.2/3) Dollars.

It is especially agreed and understood by and between the parties hereto that in no event shall the said Hyde receive as compensation for his services a sum in excess of $30,000.00

It is especially agreed and understood that the said Company will at the expiration of any thirty continuous days run of said mill and flotation plant during the said ninety days after the completion of the said flotation plant pay to the said Hyde as partial payment not to exceed fifty (50%) per cent. of the amount calculated by the Superintendent of the Butte and Superior Copper Company, Limited, to be due him on the increased earnings, if any, during the said thirty day period.

It is further agreed and understood that the remainder of the sum, if any, due to the said Hyde as compensation under this contract, shall be paid by the Butte and Superior Copper Company, Limited, upon receipt by the said Company of smelter returns on ores treated during the period, upon which the compensation of the said Hyde, if any, is based.

It is further agreed and understood that in all calculations provided for in this contract and in calculating the amount due said Hyde hereunder, all sums received or to be received by the Butte and Superior Copper Company, Limited, from the sale of lead concentrate shall be eliminated.

Plaintiff's Exhibit 2.

IN WITNESS WHEREOF, the parties hereto have hereunto set their names and seals this day and year first above written.

Butte and Superior Copper Company, Limited,
By A. B. Wolvin, Pres't.
James M. Hyde.

(Endorsed)

AGREEMENT

Between

Butte & Superior Copper Co.
Limited,
and
J. M. Hyde.

Filed May 18, 1917.

GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Plaintiff's Exhibit 2.

WHEREAS, James M. Hyde has undertaken certain work in connection with the milling operations of the Butte and Superior Copper Company, Limited; and,

WHEREAS, under the terms of a contract now existing sums of money to be paid the said Hyde are not yet due; and,

WHEREAS, the said Hyde is desirous of obtaining at this time, and in the near future, certain payments of money;

Plaintiff's Exhibit 2.

NOW WHEREFORE, the said contract existing is now modified with respect to the time of payment of moneys in the following manner, to-wit:

The said Butte and Superior Copper Company, Limited, has this day paid to the said Hyde the sum of $5,000.00 to apply upon any future payments that might be found to be due, and does agree to pay the said Hyde $5,000.00 on the 1st day of January, 1912, provided the milling operations at Basin, Montana, conducted by the said Butte and Superior Copper Company, Limited, show an increase earning by virtue of the use of the flotation plant therein installed in excess of $5,000.00 for the month of December, 1911.

The said Butte and Superior Copper Company, Limited, agrees to pay the said Hyde $5,000.00 on the 1st day of March, 1912, provided the milling operations at Basin, Montana, conducted by the said Butte and Superior Copper Company, Limited, show an increase earning by virtue of the use of the flotation plant therein installed in excess of $5,000.00 for the month of February, 1912.

It being the intent of this agreement, that if the flotation plant installed by the said Hyde at Basin, Montana, should cause an increase in the months of December and February to the extent of $5,000.00 for each month, the said Company will make the payments aforesaid to the said Hyde; the total payments, however, including the $5,000.00 paid this day, shall not exceed $15,000.00 until such time as the new concentrator of the Butte and Superior Copper Company,

Plaintiff's Exhibit 2.

Limited, is in operation at Butte, Montana, when a thirty day run of the selection of the said Hyde may be made in the same manner and within the same time as provided in the original contract between the said Hyde and the said Company, and the Company shall thereafter pay the said Hyde the sum in excess of $15,-000.00 if any, found to be due him, not to exceed, how-ever, the additional sum of $15,000.00. If no sum in excess of $15,000.00 is found to be due the said Hyde under the terms of said contract, then the said Hyde shall be considered to have been fully paid and com-pensated under the terms of said contract.

It is understood and agreed between the parties hereto that the terms of said contract with reference to the amount to be expended in the construction of the larger plant referred to in the contract heretofore existing between the parties hereto shall be consid-ered by both parties to have been fully satisfied with-out additional expenditure on behalf of the Butte and Superior Copper Company, Limited, at the Basin Con-centrator.

The right is reserved to the said Hyde to select any thirty consecutive days' run of the Basin Concentrator during the continued operation thereof by the said Company as the basis upon which his compensation shall be fixed under the said contract, and to demand that settlement be made thereon in accordance with the original contract between the parties thereto cred-iting, however, all sums theretofore paid him by the said Company as payments upon the amount found to be due him.

Plaintiff's Exhibit 3.

IN WITNESS WHEREOF, the parties hereto have hereunto set their hands and seals this 26 day of October, 1911.

James M. Hyde,
Butte and Superior Copper Company, Limited,
By A. B. Wolvin, Pres't.

Filed May 18, 1917.

GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Plaintiff's Exhibit 3.

September 21st, 1911.

J. M. Hyde, Esq.,
Basin, Montana.

Dear Sir:

With reference to the contract which J. Bruce Kremer drew up last June in accordance with terms which were agreeable to yourself and myself and which I submitted to the directors of the Butte & Superior Copper Company, Limited, for approval:

I received on July 6th, from A. B. Wolvin, president of the company, a telegram instructing me to proceed with you in accordance with the contract.

You installed and operated an experimental plant and convinced me of the economic value of your process as applied to Butte & Superior ore, and I have recommended to the directors that the larger plant referred to in the body of the contract be installed at

Plaintiff's Exhibit 3.

Basin, at once, but with certain modifications, which seemed under the circumstances governing conditions at Basin to be advisable. I shall not enumerate the conditions in this letter, as they are well known to both of us, but the literal carrying out of the agreements made in the contract with the above mentioned modifications will not be fair to you, and I wish to present to you the following proposition

You will remain in Basin until the construction of your larger plant is completed and operating, and until the man appointed by Mr. Collins to do the work shall have become thoroughly conversant with the handling of the larger unit. As long as you remain in Basin you are to receive the same amount of money to cover living expenses as was provided in the contract.

After you and I have mutually agreed that the larger plant is operating as successfully as can be expected, you will be at liberty to depart. I have in mind as the date of your departure some time between the 10th and 20th of October, but it may be sooner.

After you leave Basin, you are to continue your investigations concerning the best plans to follow in the erection of the gas bubble flotation unit, which is to be part of the new zinc mill which we are to build at Butte and advise me from time to time of your wishes in the matter, so that the plant may be built to suit you, as far as is consistent with the approximate expenditure of $10,000.00 for apparatus and construction expenses. The building proper is not included in this limit of expense.

Plaintiff's Exhibit 3.

During your absence from Basin or Butte, I shall keep you fully posted on the progress and details of the construction of the new mill, so that you can arrange to be in Butte to supervise the completion of your part of the plant and to start its operation. As soon as the plant in the new mill is running smoothly, we shall consider your 90 day test, as provided in the contract, as on.

In consideration of the extended period you will be obliged to devote to our business, you shall have the right to demand an initial payment, under the terms of the contract, of up to $7500.00 before the end of th~~e~~is calendar year. Or if you desire to remain in Basin for 90 days after your larger unit is running, and accept the results thereof as final, this is to be your privilege, and final settlement will be made under the terms of the contract.

In case of any accident to yourself during your proposed absence from Butte & Superior, which might prevent your return, the Company will consider the terms of the contract binding and pay to you or to anyone you may legally designate such sums as may be due you under the terms of this contract.

If you desire to accept the proposition, as outlined herein, please notify me to that effect and I will forward the proposal to Duluth for confirmation.

Yours very truly,

MWA/G

M. W. ATWATER.

Filed May 18, 1917.

GEO. W. SPROULE, Clerk.

By H. H. WALKER, Deputy.

Plaintiff's Exhibit 4.

1041 Shattick Ave.,
Berkeley, Cal.
April 24, 1913.

J. L. Bruce, Esq.,
Butte, Mont.

Dear Sir:—

I did not have an opportunity to see you and discuss the company's agreements with me before leaving Butte. As the original agreement does not fit conditions as they have been changed since it was entered into, it will be necessary for me to take the matter up anew with your officers. Mr. MacKelvie has suggested that we get together and dispose of the matter when he is in the west, and I am making arrangements to meet him when he is in Butte early in May.

I enclose herewith my expense account for the recent trip to Butte. The company agreed to pay my actual expenses when my time was given to the suit or to the milling operations. You will see by reference to your accounts that this has been regularly done in the past.

Hoping that all is going as well as can be desired at the mill I remain

Respectfully yours

James M. Hyde.

JLB

Filed May 18, 1917.

GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Plaintiff's Exhibit 5.

BUTTE AND SUPERIOR COPPER COMPANY
Limited
25 Broad Street
New York, July 2, 1913.

J. L. Bruce, Manager,

Butte & Superior Copper Co. Ltd.,
O'Rourke Estate Building,
Butte, Montana.

Dear Sir.

Under date of June 14th I wrote you in reference to your getting up some data in connection with the Hyde process to use as a basis of settlement with him as provided for in his contract with the company for the installation of the Hyde flotation process.

Mr. Bocking took this matter up in his letter of June 27th. Mr. Bocking forwarded me several statements showing the comparative value of the mill zinc flotation concentrates, also statement showing comparative milling costs.

The direct charges against the flotation department for the month of May he gives as $1.1881. In report form 19B, giving the distribution of cost of mill operation for repairs and maintenance, I find that the total cost against the flotation department is .873865c, so there is a discrepancy there of approximately 31c per ton.

Plaintiff's Exhibit 5.

Mr. Babbitt and myself have had a talk with Mr. Hyde this morning and we feel that the settlement of balance due on Mr. Hyde's contract should be based on report of the operating officials. The maximum amount to be paid to Mr. Hyde under any circumstances is $30,000, and of this amount he has already received $10,300.

In taking this matter up with Mr. Jackling some weeks ago, he stated that he was at a loss to suggest a method of determining what is due Hyde, if, in fact, anything is due him.

I have had in my mind the outcome of the suit of the Minerals Separation Company against Hyde, but the contract with Hyde was entered into with practically full knowledge of this pending litigation, and later the company made an agreement with Hyde to defend this suit for him and at that time did not ask for any modification of the then existing contract. I have not the contract before me but it is my understanding that Hyde had the right to take the results of any 30-day period within three months after the construction work had been completed, and it is Hyde's claim that this construction period was not ended until April of this year and that on the results for the month of May he is entitled to $19,700 as the balance due him.

There is no possible way with the data before us that we can answer any of the contentions that Hyde makes, particularly in being denied the privilege by

Plaintiff's Exhibit 5.

the former management of making suggestions in regard to the operation or application of his process.

In Mr. Jackling's absence and in view of the fact that Hyde has to return west today, I have suggested his taking the matter up with you and Mr. Kremer in Butte, and as a result of your conference with him you can recommend to Mr. Jackling and myself the proper basis on which to deal with the settlement of this matter. Mr. Kremer must, of course, be very familiar with the previous arrangements and understanding as to the application of the present contract to the new mill at Butte, although the contract was based on operations of the mill at Basin.

If at all necessary I would be very glad indeed to meet Mr. Hyde in Butte or Salt Lake after Mr. Jackling's return and finally dispose of this matter, but you can familiarize yourself with the contract and if in your discussion with Hyde there are any points you feel should be passed on by Mr. Babbitt from a legal point of view, you might wire me.

Yours very truly,

N. B. MacKelvie,

President.

Copy to Mr. D. C. Jackling.

Filed May 18, 1917.

GEO. W. SPROULE, Clerk.

By H. H. WALKER, Deputy.

Plaintiff's Exhibit 6.

En route to Washington
Jan. 5, 1911 ?
1912

M. W. Atwater,
Butte, Montana.

My dear Max:

Ever since I left you I have been studying over the matters which we discussed yesterday.

Re Rope Drive. It will be very easy for us to determine the exact amount of power necessary to drive a 24″ diam., 3″ high agitator at 300 R.P.M., and at the same time make an important experiment concerning the possibility of increasing the capacity of your Basin flotation plant at almost no cost. As the mixing boxes are 26″ in the clear they will take this size agitators, and after the test, if it is seen that they are too large for those boxes, they will be available for the new mill.

I consider this test as very important and want to withdraw my final approval of your rope drive, and ask you to hold up the order until this test is made, by one of you with or without me. As I was yesterday informed, for the first time, that the Basin machine cannot handle the tonnage for which it was planned, it seems possible that in the new mill a larger machine than has been anticipated and one that will possibly require more than 2½ H.P. per spindle may be needed.

Will you please have the Iron Works get out a set of propellers for the side of the machine which is shut down. Make them 24″ diam. 3″ high and have them bored to place on the spindles so that when they are driven as the spindles on that machine are the strengthening webs will be on the back. Rush them through if you can and have the machine already to run when I arrive if you can possibly do so.

I will have to spend a few days on personal business in Washington and New York but will rush it through and get back to Butte as soon as possible and put in enough time there and at Basin to collect the necessary data and complete the plans for the flotation department of the new mill.

As the directors asked me, after the meeting in your office at which the subsidiary contract was agreed upon, to supervise all of the planning of the flotation department they will naturally hold me responsible as to the success of the same unless my plans are ignored and overridden. I am heartily in favor of a rope drive, but we must be very certain that it will give all of the power necessary to drive the size of machine which we will have to use, and I am not yet convinced that 2½ HP per spindle will be enough.

Re Pulp Thickening. All of my experience in drawing thickened pulp from plugs, even under constant pressure, indicates that it is extremely difficult to get a flow of constant volume and thickness by that means. The more I think of the device you have planned for this work the more certain I am that it will be a source of not occasional, but constant trouble to you. There is no more important problem to be met in the new mill

Plaintiff's Exhibit 6.

than that of giving the flotation machine a feed of absolutely constant volume and thickness. It is so important as to warrant installing two complete sets of different devices in order to be certain that the best results can and will be achieved. I hope that you will save suitable space for installing two 16″ tanks and their pumps (two units of the device we discussed yesterday) and that you will see the wisdom of having them installed when the mill starts to run, so that there may be no hitch in its work.

My understanding has been that there were to be ample funds available to build the best mill that can be planned. If that is the case it will be very unwise to run any chance of not starting off right, in order to let the mill make money available for further equipment as you suggested yesterday. That policy is an extremely wasteful one as Basin has proven.

I will write a letter to Capt. Wolvin at once making my recommendations with regard to this matter, as we decided yesterday. I believe he will feel that any moderate expense which is necessary to insure the best work is warrantable.

I trust that I shall be back in about two weeks.

With best regards to you all I remain

Sincerely yours,

James M. Hyde.

P. S. Please have this typed & keep a copy for me.

Filed May 18, 1917.

GEO. W. SPROULE, Clerk.

By H. H. WALKER, Deputy.

Plaintiff's Exhibit 7.

COPY

20 B

May 17, 1913.

Mr. D. C. Jackling,
Vice Pres. & General Mgr.,
Utah Copper Co.,
Salt Lake City, Utah:

Dear Sir:

I enclose herewith bill for professional services rendered by Sheridan, Wilkinson, Scott and Richmond as referred to me by Mr. Kremer, together with correspondence regarding same. This bill seems very high and Mr. Kremer thinks in view of the fact that such considerable revenue has been derived by them for professional services in connection with the case prior to arguments of the same, that their charges for the argument are unreasonably high and that the same should be $2,000 to $2,350 less than the amount billed.

Will you kindly consider this matter, and in case you are not satisfied with approving the bill, correspond with Messrs. Sheridan and Scott until a satisfactory amount is rendered by them.

Yours very truly,

J L B

Manager.

JLB/FT

Filed May 18, 1917.

GEO. W. SPROULE, Clerk.

By H. H. WALKER, Deputy.

Plaintiff's Exhibit 8.

20

B

Nevada City, Calif.
July 15, 1913.

Mr. N. B. MacKelvie,
25 Broad Street,
New York, New York.

My dear Mr. MacKelvie:

The result of our conferences at Butte was that Mr. Bruce and Mr. Kremer came to the conclusion that it would be better if the company's officers and I could agree on a lump sum settlement and not be forced to go into a close analysis of figures and a detailed interpretation of my contract. They were led to this conclusion by the discovery that our conceptions of the way in which the contract should be interpreted were so much at variance, that as they expressed it, we could never settle on that basis without submitting the matter to an unbiased and disinterested third party as a judge or arbitrator.

Of course, such a course as that would lead to delay, expense and controversy, all of which we are all most anxious to avoid.

The admission that a substantial payment should be made seems to be inconsistent with their contention that their interpretation of the contract is defensible, as by their interpretation of the contract they are able to figure that nothing is due me. The plea that I should be willing to accept much less than I consider is due me, because the defense of my interests would be costly in time and money is perhaps a forcible argument to one in my circumstances in dealing with a powerful company, but it is not a convincing logical proof that I am not entitled to what was originally held out to me as an inducement to undertake this work, with all of the risks involved in it on the conditions under which I took it up.

As your own attitude has been so fair in this matter and Mr. Bruce and Mr. Kremer are convinced that a substantial payment should be made me, it ought to be possible for us to come to a just and friendly conclusion of the matter. My own desire is that the termination of our work together may be marked by a recognition upon your company's part of the great service I have rendered in solving your difficult ore treatment problems, accompanied with such a cash settlement that I can feel that I have been dealt with in a thoroughly fair and broad-minded spirit.

I wrote to you some time since that I should leave the matter of the interpretation of the contract entirely to your board of directors. I should not be prompted to any further explanation of the case if it were not for the great injustice and professional injury done me by the suggestion that my recommendations have lead to the installation of an unsuccessful plant which caused your company great losses, and that success was only attained after my plans were

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greatly changed by other engineers. I feel that that suggestion was prompted by a lack of knowledge of the facts of the case.

Knowing human nature as I do, I have foreseen that such a contention might possibly be raised, and I have carefully preserved my records, data, and correspondence, and have accumulated a mass of evidence which, I am absolutely confident would, in case of necessity, convince any unbiased umpire, board of arbitration, judge or jury that my plans were never substantially adopted until the month of April 1913, and that instead of my plans having caused the company great losses, the fact is that the refusal to adopt and work in accordance with my plans has cost the company an unnecessary loss of over half a million dollars.

It was not until April 1913, that the ore was ground approximately and continuously to such a degree of fineness that good recovery and a good grade of concentrates could be made simultaneously, and the pulp thickening plant was only then so amplified that it was no longer the practice to throw away a considerable portion of the finest and richest part of the ore untreated.

The tacit refusal of the old management to adopt and use my plans as called for by the contract has caused me great professional and financial damage, has denied me the advantage of a prompt demonstration of the striking value of the process I have perfected and has denied me the use of my money which would have long since been due and paid, and would have been of great value to me during the period of financial depression through which we are passing. While these are matters which were not under your individual control, they are acts of your company which you should give due consideration in coming to a fair settlement with me.

In order to take a fair view of this matter, it is essential to understand the conditions under which my relationships with the company were entered into, and the steps through which they have progressed. The misunderstandings which have arisen and the fact that some of those who are to pass upon this matter have no personal knowledge of the history of the transaction warrants a brief statement of the case.

In March or April 1911 I arrived in New York from London with H. C. Hoover. From Chester Beatty, Hoover learned that an examination of the Butte & Superior Mine was to be made by Kuehn to determine if Hayden, Stone & Co., would be warranted in taking up a bond issue on the property. I was introduced to Beatty and it was arranged that I should go along and assist Kuehn in the examination, and that when through with it I should make an independent study of the treatment of the ore at my own expense and report my findings to Hoover, who I was informed, with Beatty, was to have the privilege of participating in the bond issue, and who had agreed to carry me for an interest with them if my work showed that they were warranted in going into the venture.

After completing the regular examination, I com-

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menced a study of the ore with a test machine I had had the local iron works build for me. I got R. M. Atwater's permission to do so and he was very desirous that I should report my results to him. I refused to do so as I was making the tests at my own expense and had no occasion to report to anyone save Hoover, who I understood had some negotiations on in which he would take care of me.

Nutter, representing Minerals Separation, was present in Butte at this time, negotiating with the company, and shortly afterward went with the president and manager to New York.

Just after his return to New York, I received a request from Kuehn for some report of the results of my tests as they were needed by his principals in determining whether or not to take up the venture. After consulting my associates by wire, I furnished him with a statement that the results were satisfactory and showed that greatly increased profits were possible. I understood from him later that my report was a factor in determining his principals to take up the bond issue.

Shortly after this, I received a request from R. M. Atwater to make a study of their problem and report to them what could be done and how it could be accomplished.

At about this time I was informed by M. W. Atwater that the company had found it absolutely impossible to come to terms with Minerals Separation and that they would like to have me investigate the problem of their ore and tell them what I could do. As he was very urgent in the matter I cabled Hoover to learn how his proposition was developing, and received word from him that he was out of the venture, and to proceed independently if I saw fit to do so. I refused the meager compensation offered me by your company for a study of the problem, but told Atwater that I would make a sporting proposition out of it and would make a comprehensive study of the problem and report to them, charging them only actual costs for the investigation, on condition that they would make me a proposition after receiving my report, which proposition I would either accept or reject and give no further time to the matter.

Upon receipt of my report they made me the proposition which is embodied in my contract with the company dated July 22, 1911.

The essence of this contract was that I should carry out a test with a fifty-ton machine, receiving merely expenses for doing so, at the conclusion of which test, the company would, if the results obtained had warranted it, build a plant according to my plans and under my direction, which I should personally superintend the running of for ninety days time, and that I should receive as my compensation one and two-thirds time the increased profits made, over certain assumed previous results, in a thirty day period as a result of the use of the process introduced by me.

As first proposed, ten thousand dollars was suggested as the maximum fee to be permitted. I in-

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formed the company that as I was taking this as a sporting proposition that limit did not seem fair to me, and they raised it to thirty thousand dollars to induce me to take the matter up.

The 50-ton test machine erected and run under my directions for thirteen consecutive days gave a recovery of 91% and a product averaging 51.4% zinc as shown by assays and actual shipments.

It was decided to build a larger machine, and that part of my plans relating to the machine itself was carried out. This machine gave for the month of November, 1912, by the figures furnished me, 89.9% recovery in the form of a 48.2% product. The lower grade product was due to treating coarse material. My plans referred to in the contract were to cover the subject of pulp collecting and thickening, fine grinding of jig and table tailings, and the flotation treatment of all the ore, not recovered as jig or table concentrates. The company decided that they did not want to introduce the fine grinding and pulp thickening portion of my plans at Basin and a subsidiary contract was entered into postponing a final settlement until the completion of a mill in Butte. It was my understanding with the directors that my judgment and plans were to be followed in the new mill in those matters which were covered by the agreement with regard to the Basin mill.

For the new mill I planned the use of two four spitzkasten machines with 36′ cells, gear driven, and equipped with both air lifts and special pumps. to be

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accompanied with the use of the two three spitzkasten 28″ cell, gear driven machines from the Basin plant. That installation would ~~not~~ have had more capacity than the one now installed at Butte, and was practically of the type to which the Butte equipment was changed in April. The two machines at Basin were abandoned and left there, although they were in first class condition. The gear drives advised by me were abandoned for belt drives, which caused endless trouble and were replaced with gear drives early this spring.

My recommendation was that in addition to other pulp thickening device, there should be installed, as a safety measure, special automatic mechanical filters, which were not adopted, with the result that enormous losses of easily recoverable high grade mineral have taken place, and that the cost of treatment in the flotation department is still higher than it would be if these filters were being used to allow the re-use of the hot, acid, oil bearing water which could easily be recovered from the flotation tailings.

In my original report, in subsequent reports, in a series of brief notes prepared last fall for your engineers, and in tests and microscopic examinations made this spring, I have pointed out the absolute necessity of fine grinding if the best commercial results are to be obtained. Yet it was only in April 1913 that the fineness of crushing necessary to the obtaining of the maximum profits was adopted as a consistent policy.

Reference to my letter to you, of June 6th, 1912,

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written in response to your request that I should inform you of the outlook at the mill, will show that when the mill was first started I was foretelling the difficulties which have been experienced, and protesting, as I had done during the erection of the plant, against the management's refusal to adopt my recommendations as called for by contract.

For the refreshing of your memory and for the information of others of your directors whom I assume will see this letter, I will here again record the results which have at times followed the partial adoption of my suggestions as to how the plant should be operated. These records are suggestive of what phenomenal results would have been at any time achieved had my recommendations been carried out in full under my own personal supervision.

When I visited Butte in early December, as I returned from attending the taking of testimony in the patent suit, I found that the results which were being obtained in the mill were extremely unsatisfactory because the pulp was not being ground fine enough to treat, the slime thickening devices were inadequate for the tonnage being treated, and the use of chemicals in pulp thickening was done in such a way as to unfit the pulp for subsequent flotation treatment.

I went over all of the factors necessary for success with Frank Janney, Jr. and readjustments of manipulation were adopted and a lesser tonnage treated, giving tailings as follows:

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(I have no data at hand as to grade of concentrate, etc.)

Dec. 8, 1912,	Flotation tails 3.5, 3.1, 3.3,	Mill tails	5.1, 5.3, 5.2
Dec. 9, 1912	" " 2.4, 4.9, 2.6,	" "	3.4, 5.2, 4.3
Dec. 10, 1912	" " 2.7, 4.3, 5.6,	" "	3.6, 6.4 9.1

A study of all the mill feeds and products indicated that a recovery of 80% or better was being obtained, and certain alterations to bring the plant more into accord with my plans were agreed upon. As it would take some time to install these, I went to California.

The next I knew of results, I received word from you that the plant was making a very poor recovery, and went to Butte at once and found the following types of tails being produced:

Jan. 8, 1912,	Flotation tails 5.6, 7.0, 12.2	Mill tails	9.3, 13.2, 12.1
Jan. 19, 1913	" " 7.8, 7.4, 4.4	" "	11.6, 12.7, 8.2
Jan. 20, 1913	" " 6.0, 9.7, 6.0	" "	11.0, 12.4 7.8

A study of the operations of January 23, 1913, showed the following facts:

Ore Milled 785 tons @ 21.4% zinc

Mill concentrates 110 " @ 42.9% zinc

Flotation concentrates 120 tons @ 46.1, 46.8. 49.4

Flotation tails 470 tons @ 6.2

General mill tails 555 tons @ 8.9

Overflow slimes thrown away untreated: 85 tons @ 23% zinc.

These figures show that as the operations were

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carried on, with exactly the same equipment which gave the results shown above for January 8th, 9th and 10th, a large proportion of the zinc was thrown away as overflow slime, and that the material going to the flotation department was too coarse to give either a good recovery or a good grade of concentrate. The principal difficulty was that a larger tonnage was being milled than the mill could treat profitably.

Mr. Frank Janney, Jr. joined me at the mill, and ordered that the tonnage be cut down until the tube mills of the second section, which were standing idle, could be hooked up to handle part of the products of the first section. By correcting the tonnage and other factors, the following results were obtained:

Jan. 29, 1912 Flotation tails 2.8, 3.0, 2.9. Mill tails 5.6, 5.8, 7.3 again indicating such a recovery as obtained when operations were modified at my suggestion in December.

Even better tailings than these were obtained later, but the concentrates still showed that the grinding was not fine enough to free the quartz from the blende sufficiently to give high grade concentrates.

My suggestion that the tailings from the cleaner should be reground, which was made as early as when the mill was being planned, was adopted in April 1913, since when the concentrates have been of a higher grade.

After I had gone over the many factors involved in the work and shown Mr. Frank Janney, Sr. what my original plans called for, he did me the justice of telling me that he could see that if I had been given an opportunity to do so, I would have made a great success of the work long since.

I wish at this time to acknowledge my indebtedness to him and Frank Janney, Jr. for the efficient way in which they have adopted my plans as fast as I have been able to convince them of their practicability and for the assistance which they have rendered in whipping things into good mechanical condition.

It should be perfectly apparent to any fair-minded person that in view of the facts of the case, it would be doing me a great personal and professional injustice to hold me responsible for the poor results which have followed from spurning my plans and going contrary to my repeated counsel and advice.

Even had my plans been followed in full, instead of in part, it would have been necessary to have had all the work of pulp thickening, fine grinding and flotation done under my exclusive supervision, for such a period as ninety days, as the contract plainly called for, in order to give me an opportunity to demonstrate the economies and profits of which the process is capable, and never since the first tests on the fifty ton machine have I been permitted to have charge of all of the parts of the work necessary to insure the best results.

It is now plain to all concerned that your ore is one which is especially difficult to treat successfully,

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et I have worked out a special process for it which ives at once a higher recovery and higher grade roduct than have even been made from a similar ore o far as I can learn, and which could not be obtained y any other known process.

Had you dealt with Minerals Separation, I am informed by Capt. Wolvin that they would have deianded a royalty of 25c per ton for the period covered y the life of their patents. That would have amounted ɔ a royalty of $90,000 per year on a thousand ton ıill. Even if that rate had been cut in two, it would ave been $45,000 per year on a 1,000-ton basis, for bout twelve years time. They had never used the xact process which I have invented and patented ven in Australia where they have done most of their ork, and that exact procedure is apparently necesary in order to get such results as I have achieved ith your ore.

The fact that a patent suit would result from proeeding to use a flotation process was known to all oncerned, and the three attorneys upon the old board f directors should have been able to anticipate what suit would mean in the way of costs. Our relationhips are in no ways modified by the fact that the uit was brought in my name. Its object is to enjoin our company from the use of the process or compel t to pay a royalty, and is brought against me solely or the performance of acts carried out for your comany. Had it been brought in your company's name lirect, it would have cost as much to defend it, and

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I would have given it as much of my time as I have. I am of course aware that it will be greatly to my advantage to win this suit, and I am glad to express my appreciation of the liberal attitude of your board toward this whole matter of litigation.

I did not enter into this business as an impecunious engineer anxious for an ordinary fee. I had given up a position that would have paid me $10,000 per year in order to work for myself, and I have, during the pendency of this work and suit, refused to consider the managership of one of the largest Australian zinc companies at a salary of £3,000 per year and perquisites, in part, because it was necessary to devote my time to this case and your work.

I entered into this work as a sporting proposition, taking most unusual risks of all kinds, and considering that I was allying myself with people who were willing that, if I made money for them, I should make money with them.

The solution of the ore treatment problem which I worked out was a large factor in increasing the market value of the stock to such a point that the bondholders could, if they saw fit, make 400% on their money, and will undoubtedly assure them of future opportunity of the same sort. The maximum profit that I could possibly make out of the venture is insignificant in comparison with the contribution to the success of the business which my process has proven to be.

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I have told Mr. Kremer that, while I consider that the full maximum fee should come to me, which would entitle me to a further payment of $19,700, I will accept $15,000 to avoid any prolonged discussion and possible controversy. I really hope that your directors' sense of sportsmanship and fair play will make them recognize that that is a concession which should not be demanded, when they understand the case fully. The full amount is scant compensation for the service rendered, to say nothing of the trouble, worry and neglect of other business which have been involved in this suit to gain you the right to operate without paying regular tribute to a fraudulent monopoly.

Mr. Bruce will go ahead with the preparation of figures to submit to me if it becomes necessary to go closely into all details of cost and recovery, and I shall not go into an analysis of figures until I have their recommendations while waiting to hear from you.

At the time the contract was entered into, Mr. Atwater and I figured that the process should yield approximately 90% recovery and a 50% zinc concentrate; that the extra costs of treatment should be 55c to 65c per ton, and that, on that basis, I would be entitled to $30,000 in full when but 12,000 tons per month were being treated.

The only figures so far submitted to me show that approximately 90% recovery and 50% product have been achieved. The detailed figures which Wicks showed me for one of the early spring months showed

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flotation department costs of about 60c per ton. (I do not know how the high costs figured for May were derived.) Apparently our early forecast has been practically achieved, and on that basis by the terms of the agreement, I have assumed that the maximum fee should be due me, even if you had treated but 12,000 tons in May instead of 22,000 tons as you did.

If a settlement can be made as Kremer and Bruce suggest, on the merits of the case, it should not be necessary to await the preparation of more figures, and I shall be greatly pleased to be spared the necessity of making another long, expensive and tedious trip to attend to the matter, if it can be attended to promptly by correspondence.

However, if you consider it desirable for me to meet you and others in Salt Lake or Butte, I am willing to do so, if other plans permit, at such time as you may suggest.

I shall be glad to hear what you wish to propose in the matter.

Realizing that you agree with me in hoping that the whole affair may be disposed of within a short time, I remain

Respectfully yours,

(Signed) James M. Hyde

My address will be 1041 Shattuck Avenue, Berkeley, California as before.

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HAYDEN, STONE & CO. 20
BANKERS B
New York-Boston

New York, July 28, 1913.

Mr. J. L. Bruce,
Butte,
Montana.

Dear Sir:

For your information I am enclosing copy of a letter I received from James M. Hyde, which was written after a conference with you and Mr. Kremer.

Yours very truly,

N. B. MacKelvie

NBM..S
Enclosure
JLB

Filed May 18, 1917.

GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

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Sept. 16, 1913.

Mr. F. G. Janney,
Manager of Mills,
Utah Copper Co.,
Salt Lake City, Utah.

Dear Sir:

Complying with your request of Sept. 3rd I have gone over the attached correspondence with Mr. Shimmin, and have endeavored to show in this letter our opinion as to Mr. Hyde's connection with the flotation process.

We have gone back over the early records and correspondence in connection with the subject and, with the exception of three or four free hand pencil sketches cannot find in the files any drawings, blueprints or designs of any description which were gotten up by Mr. Hyde, nor any that bear Mr. Hyde's signature of approval, nor can I find any record of his having submitted any detailed drawings of flotation machines or flotation installations of any kind.

In numerous letters Mr. Hyde refers to the preparation of plans and to the various schemes which he had in mind but there is no record of any finished drawings having been submitted which could have been used in the erection and installation of machines of his design. The sketches, notes, etc., which Hyde did submit to this company are on file and originals or copies of

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them can be forwarded to you should you desire them, but they are for the most part free hand, without dimensions and decidedly incomplete and they bear very slight resemblance to the machines now operating.

It is very evident from the early correspondence in this matter that from the beginning of Mr. Hyde's connection with this company a great amount of difficulty was experienced in obtaining from him any definite design or description of the type of machine which he desired them to install in the first place, and after the original machines were erected and failed to produce the desired results, his suggestions for improvement were decidedly hazy and intangible and consisted principally of criticism of the installation as it existed rather than instructions for improvement.

These conditions existed from the first, but copies of letters written to Mr. Hyde by Mr. Atwater indicate a willingness on the part of the Butte & Superior to follow Hyde's instructions on the first installations, as the flotation problem was entirely new to any connected with the company. The difficulties encountered in obtaining satisfactory results from Hyde's work is shown in the following paragraph quoted from Mr. Atwater's letter to Captain Wolvin under date of Oct. 4th, 1911, a signed copy of which is in our files:

> "Hyde has proved to be an excellent theorist, but a very poor practician. His process, I am sure, is all right, but Collins and his men have had to put it into shape to run and Hyde's repeated

mistakes in the design of apparatus and his inattention to minor, though important, details have consumed a good deal of unnecessary time. I have always given him a free hand and made it a point not to interfere in any way with his plans and projects, except as to their magnitude, but recently while discussing the failure to work properly of several features of his old and new plants, he said that he did not consider himself to be a practical man in any respect; so I proposed that he explain his process fully to Collins and leave all further points of construction as well as details of operation to Collins with Hyde acting as an advisor only and not as an administrator as heretofore. Hyde gladly accepted this arrangement. He and Collins got along very well together and I think that henceforth there will be fewer jobs in his department that will have to be done twice or three times before they are correct."

You will note that this letter was written less than three months after the closing of the contract. This shows clearly the difficulties which were experienced in obtaining satisfactory results from the first machine erected, and it was only by repeated alteration and rebuilding that the machine produced any results at all. About three months later, or in February of 1912, Mr. A. H. Rogers made a test of the flotation installation at the Basin plant and in conclusion on Page 23 of Mr. Rogers' report, dated March 5th, 1912, he says:

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"The process has shown to be well adapted to the treatment of the Butte & Superior ore, even as carried out in the apparatus installed at Basin. It is believed, however, that there is room for improvement in ~~their~~ this apparatus attaining thereby both improved metallurgical and economic efficiency......Experiments to decide the best type of apparatus are strongly recommended before deciding on the design of apparatus to be installed in the new mill......It appears therefore that there will be a very decided advantage in the use of the process in the new mill but no time should be lost in deciding on the form of apparatus to use."

During the early part of 1912 there was considerable correspondence between Mr. Hyde and Mr. Atwater discussing various designs which both had in mind leading up to a cablegram from Hyde who was then in London. This cablegram is dated July 30th, 1912, and reads:

"Am forwarding plans new pumpless machine on one level. Await these before building new machine."

(Signed) Hyde.

The plans referred to were those referred to in his letter from London the following day in which he says:

"I am enclosing herewith a sketch with dimensions for a new flotation machine for the uncompleted side of the mill. It is along a line discussed between myself and Mr. T. J. Hoover over a year ago......Referring to the sketch you will note that the machine consists of a number of agitators and overflow boxes built together into a single continuous tank through which the froth flows in a practically straight line."

The machine referred to in this correspondence was built as shown by Mr. Atwater's letter to Mr. Hyde dated Aug. 27th, 1912, in which he says:

"I also have for acknowledgment your cable of July 30th requesting that we await for plans of new pumpless machine. Your letter describing the new machine and enclosing sketch of same arrived in due time. We have five cells complete according to your drawing and are now putting them into place. The grave doubt that I have in my mind that the machine will work is caused by the small settling area of your spitzkasten."

In this letter Mr. Atwater goes on to explain to Hyde a number of improvements which they had made in the machines then operating and in conclusion says:

"At the Butte Reduction Works the Minerals Separation have built a machine just like the drawings that you sent me excepting that they have a spitzkasten in front of every cell and the propellor in each cell acts as a suction for the feed from the spitzkasten back to the next propeller. I believe

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this will be an improvement over yours because it looks to me as though there would be a heavy deposit in each spitzkasten as you have drawn them; but if the machine will work the advantages of doing away with the pumps and more uniform flow through the machine are so obvious that we will try it as soon as we can."

The machine referred to in this correspondence was at that time being built according to Mr. Hyde's sketch as nearly as possible. It consisted of six agitators in one row while the spitzkastens were inserted between the agitators so as to form one continuous line of boxes. The depth of the spitzkastens was designated as 16 inches below the water line and this machine bears scarcely any resemblance to the one now in use.

On Sept. 11th, 1912, Hyde answered Mr. Atwater's letter of August 27th by submitting two additional sketches showing a machine having the same identical type of spitzkasten but the agitators and spitzkastens were placed in separate lines or rows and connected by means of 6″ pipes so that the pulp might flow alternately from an agitator to a spitzkasten and thence to the following agitator. This change in design was produced by Mr. Hyde principally to make it different from the one which the Minerals Separation were building at the Butte Reduction Works but in this letter Hyde did not attempt to explain to Mr. Atwater why any of the difficulties which Atwater anticipated would not result after the machine had been completed. In fact he offered absolutely no suggestions except one taken from an old report of Froment's in which he suggests a revolving rake in the spitzkasten to prevent the coarse material from settling.

On November 9th, 1912, Mr. Atwater wrote to Hyde who was then in New York on his way home from London. In this letter Atwater says:

> "........The flotation unit which we built in accordance with the drawings you sent us from London did not work out at all. The pulp would not float through the machine and if it had flowed through the machine the spitzkasten would have been much too small to allow the concentrate to rise as well as in the old machine. I think before you left here we had begun to install 8′ spitzkasten in place of the shorter ones and the spitzkasten on the new machine were much smaller than those on the original machine."

He also goes on to say that difficulty was still being experienced with the treatment of slimes and that the Minerals Separation at the Butte Reduction Works were having the same trouble: "to-wit:

> a very high oil consumption and a very poor recovery whenever the percentage of slimes in the feed becomes great. Green has been running a number of tests on the flotation feed to determine a benefit derived by allowing the pulp to stand for a period of time in contact with a weak

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solution of acid before treatment. He finds that whenever he allows the flotation pulp to stand for an hour or more with addition of two pounds of acid per ton of solids that he gets a good tailing and a good concentrate in the laboratory machine, regardless of the percentage of slimes and using from four to six pounds of oil per ton of ore. His tests have been so successful that we are now preparing to handle the mill pulp in this manner."

He then goes on to explain the method of operating the settling tanks which it was expected would give the desired time for acid bath and in conclusion he says:

"I would like very much to have your opinion on the above mentioned points...... We will get more slimes into the flotation plant from the North side of the mill than we are now getting from the South side and I think that the flotation heads will be much lower in grade, therefore the outcome of the acid digesting scheme is of material interest."

In reply to this letter Mr. Hyde wrote from the offices of Hayden, Stone and Company, New York, under date of Nov. 18th, 1912:

"Your letter of Nov. 9th was received. I am sorry to hear that you still have trouble with the treatment of slimes and think that the prolonged treatment of weak acid which you suggest is very likely to be helpful. In the final adjustment of the plant, however, one of the most vital matters to be arranged will be to have the crushing so adjusted that an absolute minimum of slimes will be made."

Nothing further in the way of suggestions, advice or criticism is offered in the remainder of this letter and Hyde does not refer in any way to Atwater's statement that the flotation unit, which was built according to Hyde's design, had proven an absolute failure even though he acknowledges receipt of the letter containing this statement. In the latter part of the letter, which consists mainly of a discussion of the possible value of pine tar oil, Mr. Hyde says:

> "I will leave here within a few days on my way to California and will stop off at Butte and see if I can be of any further assistance to you."

About that time my own personal knowledge of the matter began and I recollect very clearly that Mr. Atwater discussed the situation with me, outlining the various events indicated by the correspondence quoted from, and it was very evident at that time that Mr. Atwater had practically abandoned the idea of obtaining any satisfactory results from Hyde's design or his advice or his presence at the plant. Neither Hyde nor anyone here at that time could give the reasons for the inefficiency of the flotation

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plant as it was considered more or less of a mystery among all concerned, except Shimmin, who told me upon my first visit to Butte in November that he and Peterson "could fix up flotation if the bunch would give them a chance."

The scheme for time treatment of slimes mentioned in Mr. Atwater's letter of Nov. 9th was a plan suggested by Shimmin and he had Green do the first work on this proposition, and submit a report together with a proposed flow sheet which would admit of time treatment of slimes by acid. Shimmin worked with Green on this proposition for some time and it was a modification of this plan which represented the final solution of the problem of successfully treating slime material in the flotation plant.

Shimmin saw the Hyde machine operating, or rather was present during several attempts to make the machine run, and he states that it was absolutely impossible to get a flotation pulp of any consistency to flow through the machine and that the action of the agitators in the agitator cells threw most of the feed out of the machine altogether. You will note that this was Hyde's design of a machine for the uncompleted side of the new mill. The machine which was then operating in the other side of the mill consisted of three spitzkastens on the rougher side and three on the cleaner side. I do not know just what the original installation in the new mill consisted of but the equipment which was operating in October and November of 1912 had at that time been altered, remodeled and torn out and rebuilt a number of times since the beginning of operations in June and none of the arrangements which had at this time been devised and proven in any way satisfactory. There was nothing in the results being obtained at that time which would indicate any likelihood that a 90% recovery and a 50% concentrate would ever be obtained by the use of the flotation process in connection with the jigs and tables.

There is nothing in the correspondence or sketches on file to indicate the truth of Mr. Hyde's statement that for the new mill he had planned to use two four-spitzkasten machines with 36″ cells, gear driven, together with two three-spitzkasten 28″ cell gear driven machines from Basin. There are several sketches of double 3-cell machines but the first 4-cell machine shown is the cleaner which was designed in December, 1912.

Regarding the 28″ cell machines at Basin which Mr. Hyde states were abandoned and left at that place, although they were in first class condition, appear to have been left at Basin by direction of Mr. Hyde as on May 24th, 1912, Hyde wired Mr. Atwater from New York as follows: "Want machine left at Basin if possible without involving any complications by leaving it open to inspection."

In December of 1912 when you were here with Mr. Jackling and Mr. Bradley on the way to Alaska, Hyde was here also and at that time there were two machines designed by Mr. Bradley who put into logical form the recommendations of Mr. Hyde. One of these machines

Plaintiff's Exhibit 9.

was the fifty ton test machine which was later partly erected but not finished on account of our work in connection with the big machines having shown that the fifty ton test machine was in no way adaptable to the work it was expected to do. This test machine is in no way similar to the large machines now operating but was considered by Mr. Hyde as the acme of perfection and was built from plans approved by him. The other machine designed at that time was the 4-cell cleaner machine which caused us so much trouble during January and February. This consisted of four agitators and four spitzkastens but the type of spitzkasten was entirely incorrect in that it was too wide along the overflow weir and too short when measured from the agitator side to the weir so that we found it actually produced at times a lower grade of concentrate as a finished product than was produced on the first and second cells of the rougher machine of local design which was then operating in connection with the cleaner. This cleaner machine was built absolutely according to drawings gotten up by Mr. Bradley and with Mr. Hyde's approval and it was operated, if I remember correctly, until we shut down in April to remodel the whole flotation plant.

At the time of Mr. Hyde's visit in December neither the mill nor the flotation plant were doing satisfactory work on account of the fact that we were changing from the old section to the new or remodelled section of the mill. In my report covering the first ten-day period of December I stated

Plaintiff's Exhibit 9.

"Operations were somewhat irregular and results a little erratic due to the starting of Section Two and closing down of Section One on the third and fourth of the month."

In Hyde's letter he enumerates the tailings assays of December 8th, 9th and 10th showing the difference between the flotation tailings and the general mill tailings. These assays were correct so far as the samples were concerned but they did not represent the actual work of the plant as mineral was accumulating in all portions of the mill such as the new elevator pits, new 40′ settling tanks and other places so that the flotation plant received a much smaller tonnage of actual mineral during the first few days of operation of Section Two than was represented by the tonnage taken in at the head of the mill. This is shown by the fact that the tailings on the 11th averaged 8.1% and the average for the month of December was 7.1% in addition to which there was an under-run for the month of 676,000 lbs. of zinc which would represent a 1% higher tailing than the assays indicated on account of mineral accumulated in various portions of the mill.

The alterations mentioned in Mr. Hyde's letter which were at that time agreed upon consisted of the installation of the new cleaner machine of his design and the installation of a few additional potform pumps of Hyde's design to take the place of the air lifts or to assist them in handling the feed. Contrary to Mr.

Plaintiff's Exhibit 9.

Hyde's statement as to the results obtained during January there was an improvement in recovery during that month as compared with December. During December the mill produced 3,985 dry tons of zinc concentrate averaging 47.8% representing a recovery of 61%. In January the mill produced 5,604 dry tons of zinc concentrate averaging 47.6% zinc which produced a recovery of 68% showing that the net increase in recovery was approximately 7%. The high grade of averaged general tailings in January was caused partly by a larger tonnage being treated but was principally due to the intermittent operation of the flotation plant and also to the retreatment of a large quantity of slimes which had accumulated in the 40′ settling tanks during December and the first part of January. You will recollect that at the time of your visit here with Mr. Janney, Jr., in January, after your return from Alaska, we were having trouble with the Garfield tables and among other changes made by Mr. Janney, Jr., at that time he had the riffles changed on these tables, increased the slope of the decks and made other changes which greatly improved their work. This materially improved the work of the entire mill, relieved the flotation plant of considerable mineral and by making a very large recovery of coarse concentrate at the expense of the grade we were able to show an improvement in the estimated recovery of the entire mill. The operation of the tube mills on Section One mentioned in Hyde's letter was not suggested by him as we had previously taken this matter up with Mr. Janney, Jr. I recall that at that time Mr. Hyde was complaining that the material for flotation treatment was not ground to the correct fineness and that there was also too much slime in the flotation feed and his suggestion to Mr. Janney, Jr., in my presence was that all feed to the flotation plant be ground through 50 mesh. In the discussion which took place about that time between Green and Hyde and others, it was deemed essential by all concerned that the flotation feed consist of a combination of various sizes of sand together with a limited amount of slime. It was the general impression at that time that neither a slime feed nor an entirely sand feed was desirable but that a mixture of various sizes was required, the theory being that the coarse particles assisted in bringing up the fine particles of mineral and also admitted of more rapid settling of the silicious portion of the pulp. It was for that reason that Hyde stated that he believed the best results might be obtained by grinding through 50 mesh instead of grinding finer on account of finer grinding producing too large a proportion of slime for flotation treatment. This is quite contrary to Hyde's original report in which he states that best results would be obtained by grinding through 150 mesh screen in order to obtain an ultimate recovery of 90%.

All of the improvements made in the flotation plant such as the addition of spitzkastens, rearrangement of flow, etc., made during the first three months of 1913, were made by direction of Mr. Janney, Jr., These were

P. 4943, L. 4, insert "suggestion or a single" after "single"

Plaintiff's Exhibit 9.

improvements suggested by him or improvements suggested by the boys at the plant and approved by him.

I cannot recall a single criticism made by Hyde which upon being adopted represented a permanent and positive improvement and I am quite confident that had the operation of the flotation plant been left in sole charge of Mr. Hyde it would be today in the same chaotic condition that it was in at the time I first saw the plant in October. Had Hyde been capable of producing equipment for a flotation process and of operating the equipment after it was installed there had surely been ample time and ample opportunity allowed prior to December 1st, 1912. Even though he was not given direct charge of the operations after that date, it would have still been possible for him to have design~~ated~~ed and erected a machine of correct arrangement had he been capable of doing so.

During March and the first part of April a tremendous amount of work was done in an experimental way in order to determine every weak point in the mechanical arrangement of the plant and also to determine the exact requirements for correct flotation treatment. In this work those of us at the plant consulted no one except yourself and Mr. Janney, Jr., and while Mr. Hyde did make a few recommendations to me, I referred them to Mr. Janney, Jr., and I am free to state that I cannot recall a single one of his recommendations having been adopted except the addition of acid at the sludge tank along the lines originally proposed by Mr. Shimmin several months before that.

Plaintiff's Exhibit 9.

The design of the machines which are now operating did not seem to be along the lines desired by Mr. Hyde and so far as I know did not originate from any plans submitted by him. You will remember that you had Mr. B. A. Mitchell from the Utah plants here at the time and that he designed the gears and gear case, making it possible to install a gear drive which did not have the objection of excessive noise which the previous installations had been burdened with. I remember that this gear case was your own idea as I was present at the conference we had in the hotel one evening when this and other matters in connection with the design of the machine was being taken up. The present ribbed liner for the agitation cells was of your design and I think originated from a suggestion made by Peterson and Shimmin as they had been doing experimenting with wooden baffles in the cells before your visit at that time. The spitzkastens now in use on the No. 1 rougher are remodelled spitzkastens remaining from one of the earlier machines but those on the No. 2 rougher are entirely different from anything which had been built before and entirely unlike any sketch or design which had ever been submitted by Mr. Hyde. Both of these roughers have since been provided with one additional spitskasten of the new style which has added greatly to their efficiency. The cleaner machine was provided with new style spitskastens and the new style liners in the agitation cells.

For the first time in the history of flotation opera-

P. 4945, L. 5, insert " up to that time it had to produce a rough concentrate " after " but "

Plaintiff's Exhibit 9.

tion here we began using the system of producing a middling product on the 3d and 4th rougher cells after the remodelling. This scheme had been experimented with somewhat during March but on all spitskastens of the rougher machine and this rough concentrate was sent to the cleaner for retreatment. Since April we have been making a middling product on all spitskastens of the rougher machine except the first two which produce a rough concentrate for retreatment in the cleaner. The middling products from the other spitzkastens are about the same class of material as the tailings from the cleaner machine and these products are combined and returned to a tube mill for regrinding. New methods of adding oil and acid were also devised at that time and in fact the whole process was given a complete and thorough remodelling along radically different lines from anything which had heretofore been submitted. These changes were made entirely without consultation with Mr. Hyde, so far as I know, and were, for the most part, made without his knowledge. He had absolutely nothing to do with the success of the remodelled plant and from his remarks at the time he did not anticipate successful operation from the new arrangement. Since his departure from the plant, additional improvements and new methods of operation have been devised which has brought the flotation plant up to its present efficient condition, which is the production of a 50% concentrate and a recovery of 90% of the total metal content when operated in connection with the jigs and tables which is the

Plaintiff's Exhibit 9.

result which Mr. Hyde stated could be obtained by the use of a process according to his plans.

So far as Shimmin and I were personally concerned, our association with Mr. Hyde was always most pleasant but even though neither of us knew anything of the flotation process at first, his advice and instruction was of very little assistance to us in obtaining a personal knowledge of flotation. I believe we all obtained more benefit from the reading of Hoover's book on flotation than we did from association with Mr. Hyde as his advice was rather unreliable and his opinions varied from day to day and his description of mechanical arrangement rather vague so that it was difficult to arrive at any personal opinion regarding any phase of the process from the information obtained from Hyde. I know that both Shimmin and Green, as well as the operators in the plant, considered Hyde's presence detrimental and had no confidence in his ability to remedy defective conditions and I am also certain that his services were actually harmful in that he knew so little of the process as to cause his advice to be actually misleading.

Yours very truly,

F. R. Wickes

FRW/FT Mill Superintendent.

Filed May 18, 1917.

GEO. W. SPROULE, Clerk.

By H. H. WALKER, Deputy.

Plaintiff's Exhibit 10.

HAYDEN, STONE & CO.
Bankers

NEW YORK-BOSTON
NBM-K

New York, Mar. 1, 1913.

Mr. Allen H. Rogers,
C/o Butte & Superior Copper Co. Ltd.,
Butte, Montana.

Dear Sir:

Under date of February 6th, I received a bill from Mr. J. M. Hyde, which I am enclosing your herewith, amounting to $601.70, for expenses which I understand are in connection with the litigation of the flotation process.

In the contracts that we have with Mr. Hyde, I cannot find any reference to providing for these payments, but I understand from Mr. Babbitt that the company agreed to assume these and Hyde also points this out in previous accounts rendered in the early part of 1912, so will you kindly have instructions given for a check to be sent to Hyde, at 1041 Shattuck Ave., Berkeley, Cal., for the enclosed bill?

Yours very truly,

N. B. MacKelvie.

Plaintiff's Exhibit 10.

BUTTE AND SUPERIOR COPPER COMPANY, Ltd.

Jan. 29, 1913—191—

AUDITOR:

Pay to James M. Hyde,
For the Items and amounts listed below:

Room & Meals New York Oct. 9th to Nov 13, 1913, Incl.	$245.00
Carfare, Baggage & Telegrams, etc., in New York	17.50
Fare New York to Butte	75.50
Hotel, etc., Butte on Return Trip	55.50
	$393.50
Round trip Berkeley to Butte January & February 1912	100.00
Thornton Hotel	85.70
Incidental meals, carfare, baggage, etc.	22.50
	$601.70

Approved ....

Filed May 18, 1917.

GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Plaintiff's Exhibit 11.

BUTTE AND SUPERIOR COPPER COMPANY
Limited.

Butte, Mont., March 6, 1913.

VOUCHER

PAYABLE TO James M. Hyde, ... $601.70
SIX HUNDRED ONE and 70/100 . . . . DOLLARS
Approved for Payment Approved for Payment

.... C. M. Everett

DETAILS OF VOUCHER

As per statement of Jan. 29th, 1913 and Mr.
MacKelvie's letter of March 1st, 601.70

Entered
Ledger

DISTRIBUTION

ACCOUNTS PAYABLE

....

....

.... 601.70

No. 5958

Filed May 18, 1917.

GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Plaintiff's Exhibit 12.

BUTTE AND SUPERIOR COPPER
COMPANY
Limited

Butte, Montana, March 6, 1913.

No. 5958

Pay to the Order of James M. Hyde, ... $601.70

SIX HUNDRED ONE and 70/100 . . . DOLLARS

BUTTE & SUPERIOR COPPER COMPANY, Ltd.
By C. M. Everett

To The
FIRST NATIONAL BANK
Butte, Montana

Special

(Paid Mar 17 1913)

(THE FIRST NATIONAL BANK
OF BUTTE MONTANA)

(Endorsed)

Your endorsement hereon constitutes receipt in full for account as per statement which you have detached from this check.

James M. Hyde

Plaintiff's Exhibit 12.

(Pay to the Order of ANY BANK OR BANKER)
(All Prior Endorsements Guaranteed)
(FIRST NATIONAL BANK)
(90-42 Berkeley, Cal. 90-42)
(MORTIMER, Cashier)
(Mar. 11 1913)
(PAID Mar 17 1913, STATE SAVINGS BANK)
(BUTTE, MONT.)
(PAYING TELLER)

(PAY TO THE ORDER OF ANY BANK,)
(BANKER OR TRUST CO.)
(Previous Endorsements Guaranteed)
(UNION BANK & TRUST COMPANY,)
(93-29 BUTTE, MONT. 93-29)
R. O. Kaufman, Cashier

(Pay to the Order of Any Bank or Banker,)
(Prior Endorsements Guaranteed. C MAR 11 1913 Z)
(CALIFORNIA NATIONAL BANK,)
(Sacramento, Calif.)
(FRED W Cashier)

Filed May 18, 1917.

GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Plaintiff's Exhibit 13.

AUDIT BILL

BUTTE AND SUPERIOR COPPER COMPANY, Ltd.

Apr. 30, 1913—191—

AUDITOR:

Pay to James M. Hyde, 1041 Shattuck Ave., Berkeley, Calif.

For the items and amounts listed below:

Expense account Jas. M. Hyde during months of March and April, 1913, in connection with Mill and Patent Suit as per attached $325.65

Chgd

H. A. Atloff (?)

Approved: J L B

Expense Account of James M. Hyde in Attendance on Mill and Patent Suit. March and April 1913.

San Francisco to Butte and return Ticket, Pullman, Meals, etc	$112.25
Thornton Hotel	181.90
Lunches and incidentals	18.75
Supplies, expressage, etc. in connection with suit	12.75
	$325.65

O.K.

JLB

Plaintiff's Exhibit 13.

BUTTE & SUPERIOR COPPER COMPANY
LIMITED

Butte, Mont., May 2nd, 1913.

VOUCHER

PAYABLE TO James M. Hyde, . . . $325.65

Three hundred Twenty five and 65/100 . . Dollars

Approved for Payment Approved for Payment

.... C. M. Everett

DETAILS OF VOUCHER

As per expense bill of April 30th, 1913
in connection with Mill and Patent Suit. 325.65

Entered
Ledger

DISTRIBUTION

ACCOUNTS PAYABLE

....

.... 325.65

No. 6323

Filed May 18, 1917.

GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Plaintiff's Exhibit 14.

Seal on car So. 15679.

(Physical Exhibit)

Filed May 18, 1917.

GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Plaintiff's Exhibit 15.

Memorandum of car.

(Physical Exhibit)

Filed May 18, 1917.

GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Plaintiff's Exhibit 16.

Bag containing concentrates.

(Physical Exhibit)

Filed May 18, 1917.

GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Plaintiff's Exhibit 17.

Bottle containing concentrates after treatment.

(Physical Exhibit)

Filed May 18, 1917.

GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Plaintiff's Exhibit 18.

Admitted.

Third Annual Report of Butte & Superior Company.

Part admitted and read in record and withdrawn by plaintiff.

MR. GARRISON: (Reading) "The litigation in connection with the Minerals Separation, Limited, which, at the date of the last annual report was pending and undecided on appeal, in the United States Circuit Court of Appeals at San Francisco, has since that time been decided in favor of your company by the Court of Appeals holding the patents of the Minerals Separation Company, Limited, as absolutely void. This question has been taken to the Supreme Court of the United States, where it is now pending, and a decision cannot reasonably be expected before some time in the spring or summer of 1916. Your directors have no reason to modify to any extent the expressions in the last annual report regarding the final outcome of this litigation. Respectfully submitted, N. Bruce MacKelvie."

Filed May 18, 1917.

GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Defendant's Exhibit 19.

Admitted.

Advertisement in Mining & Engineering World, December 30th, 1916. Page 12.

Mining and Engineering World

THE FLOTATION PROCESS

All rights under this process in North America are now controlled by

MINERALS SEPARATION NORTH AMERICAN CORPORATION

The Supreme Court of the United States having established the validity of the basic patent for froth flotation, notice is renewed that the Company is ready to grant licenses for the use of this process to those who wish to install and use it.

To those who have infringed the patent, notice is given that a settlement for past infringement must precede the granting of licenses for future use of the process.

Notice is also given that the Company will enforce its patents and will stop all infringements.

The Company maintains a laboratory for testing ores by flotation, and samples sent to its Chief Engineer, Mr. Edward H. Nutter, at its San Francisco address will be tested at minimum expense to prospective licensees. No one else is authorized to represent the

Company or to introduce its process and apparatus into the United States, Canada or Mexico.

MINERALS SEPARATION NORTH AMERICAN CORPORATION

Merchants Exchange Building
San Francisco, California.

61 Broadway
New York, N. Y.

Filed May 18, 1917.

GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Defendant's Exhibit 20.

Admitted.

Copy of Mining & Engineering Journal,
December 23rd, 1916. Page 35.

THE FLOTATION PROCESS

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To those who have infringed the patent, notice is

Defendant's Exhibit 20.

given that a settlement for past infringement must precede the granting of licenses for future use of the process.

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Merchants Exchange Building
San Francisco, California.

61 Broadway
New York, N. Y.

Filed May 18, 1917.

GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Defendant's Exhibit 21.

Admitted.

Page 55, of Salt Lake Mining Review,
January 15, 1917.

THE FLOTATION PROCESS

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Defendant's Exhibit 22.

sent the Company or to introduce its process and apparatus into the United States, Canada or Mexico.

MINERALS SEPARATION NORTH AMERICAN CORPORATION

Merchants Exchange Building
San Francisco, California.

61 Broadway
New York, N. Y.

Filed May 18, 1917.

GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Defendant's Exhibit 22.

Admitted.

Page 15 of Mining & Scientific Press,
January 6, 1917.

THE FLOTATION PROCESS

All rights under this process in North America
are now controlled by

MINERALS SEPARATION NORTH AMERICAN CORPORATION

The Supreme Court of the United States having established the validity of the basic patent for froth flotation, notice is renewed that the Company is ready to grant licenses for the use of this process to those who wish to install and use it.

To those who have infringed the patent, notice is given that a settlement for past infringement must

Defendant's Exhibit 23.

precede the granting of licenses for future use of the process.

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MINERALS SEPARATION NORTH AMERICAN CORPORATION

Merchants Exchange Building
San Francisco, California.

61 Broadway
New York, N. Y.

Filed May 18, 1917.

GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Defendant's Exhibit 23.

Admitted.

Page 10 Boston News Bureau, February 21, 1917.

THE FLOTATION PROCESS

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MINERALS SEPARATION NORTH AMERICAN CORPORATION

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Defendant's Exhibit 23.

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MINERALS SEPARATION NORTH AMERICAN CORPORATION

Merchants Exchange Building
San Francisco, California.

61 Broadway
New York, N. Y.

Filed May 18, 1917.

GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy

Defendant's Exhibit 24.

Admitted.

Page 14 New York Commercial
January 15, 1917.

MINERALS SEPARATION FLOTATION PROCESS

The flotation process for the concentration of ores is the latest and greatest invention in metallurgy. It has revolutionized the art of concentrating the ores of zinc, lead and copper. It gathers up with these metals the traces of gold and silver found associated with them and it has even entered the domain of purely gold ores. It has changed the metal values in great mounds and hills of dumps, previously rejected as worthless, into dollars and pounds sterling. It has not only reclaimed the waste of the past, but is preventing the waste of the present. The leanest ores and dumps are now made to yield their medium of values to this process on easy terms of substantial profit, and the yield from ordinary mining operations has in many instances been raised from modest earnings to fabulous profits.

MODE OF OPERATION

This marvellous invention utilizes little bubbles of air coursing through a muddy ore pulp of finely ground ore and water, to pick out and attach to themselves the valuable metal particles and to repel and reject the useless particles of dirt, rock or sand, or as it is generally called, gangue. The metal particles and air bub-

Defendant's Exhibit 24.

bles once united cannot be separated. Each little air bubble gathers up a load of metallic particles, and when given a reasonable opportunity will float them to and through the surface of the pulp and form, resting upon the surface of the pulp, with other metal laden bubbles, what is in fact a water-air froth of metal carrying bubbles. Air bubbles and froth, the very symbols of things transitory and useless, have now been harnessed to the service of man as persistent and reliable agents to carry out his will in a manner bordering on the miraculous. On a quiet surface the froth persists for days. In practice the froth may be adjusted to such persistence as will assure that the froth will overflow from the top of the liquid, pushed along by constantly rising bubbles and new forming froth, and safely carrying the metallic particles into a launder or trough, ready for the smelter.

PRACTICAL ADVANTAGES

By this process concentrates of any desired richness may be obtained, with a recovery so high that it was proved in one of the litigations involving the process that its adoption by five of the leading porphyry copper mines of the United States would effect a yearly saving at normal market prices (not war prices) of at least $17,000,000.

ORDINARY WATER CONCENTRATION

The metallic particles are usually considerably heavier than the gangue particles. Therefore in the

Defendant's Exhibit 24.

ordinary process of ore concentration advantage is taken of this fact to separate the particles by the difference in their sinking power in water. A great amount of machinery is used, principally jigs, shaking tables and vanners, all these machines depending upon this difference in sinking power. The gold miner's washing pan is the simplest example of this kind of gravity treatment. The new process, however, does the very opposite thing, it floats the heavy metallic particles above the surface of the water and permits the lighter rock or gangue particles to sink or to remain suspended in the water. It operates in fact, by picking out the heavier metallic particles and lifting them up out of the water.

HISTORY OF THE INVENTION

The flotation process was invented in March, 1905, in London, England, at the metallurgical laboratory of Minerals Separation, Ltd. The inventors are Henry Livingstone Sulman, Hugh F. K. Picard, and John Ballot. They were investigating a concentrating process invented by Arthur E. Cattermole, wherein by using oil in the proportion of from forty to one hundred and twenty pounds per ton of ore, the metallic particles were coated with a thin sticky film of oil and by agitation they were agglutinated together into larger agglomerates or granules which would reliably sink against a current of water sufficient to carry the gangue upward and away. This metal sinking process was in itself a great ~~advantage~~ advance in the art, since it saved

Defendant's Exhibit 24.

all the valuable metallic slimes (extremely fine particles necessarily produced in every crushing or grinding process) which in all other then known processes were carried away to waste with the gangue. They had studied this Cattermole metal sinking process for more than two years and were then erecting a concentrating plant at Broken Hill, Australia, to carry out the process on a large~~r~~ scale. They had improved the Cattermole process, and in improving it they had unwittingly assembled all the conditions for the froth flotation ~~agitation~~ process, even including an abundant aeration of the pulp, although that aeration was a useless incident of the violent agitation necessary for the Cattermole process as carried on in the type of agitation vessel which they used. Having developed and largely improved the Cattermole process to a working basis, they decided to carry out a series of experiments investigating all of the factors of that process, and as a part of this investigation to reduce the amount of oil step by step, observing the results and pursuing the investigation to the vanishing point. This work was carefully, systematically and well done under their instructions by one of the staff of Minerals Separation, Arthur Howard Higgins, an able metallurgist, who has since contributed largely by his inventions to the improvement~~s~~ of the process. As the amount of oil was diminished below Cattermole proportions, the Cattermole phenomena disappeared and no effective sinking of metal was obtained and the results were worthless. Nevertheless the reduction was persisted in, and,

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to the surprise of everyone a persistent metallic froth came to the surface. This, with the ore and oil used, reached its maximum in metal flotation with about two pounds of oil to the ton of ore, one-tenth of one per cent. of the weight of the ore, one part of oil to a thousand parts of ore. On examining this metallic froth it was found that the oil had disappeared from sight and touch and had lost all its ordinary qualities. Chemical investigation showed that it was upon the concentrates, but in a film, so attenuated that its presence could be detected only by chemical means. It was found that the oil when present in this minute quantity had the peculiar function of controlling the formation and action of the air bubbles so as to effect minute bubble formation and so as to assist the selective action of these bubbles for metallic particles, and so as to give practical permanency to the bubbles, both when immersed in the liquid and when gathered above the liquid in the froth.

THEORIES OF OPERATION

The explanation above given is the extent of exact knowledge of the process which repeated scientific investigations have determined. The process has not yet been fully explained. Numerous theories have been advanced, and at one time electrical theories were favorably regarded, but the complete explanation of the mysterious operations is yet to come. The inventors, however, having found out how to work the process, did not wait to discover why it worked, but immediately put it to work, and the Cattermole plant in Australia was altered to carry on the new process. They also patented it practically all over the world.

METALLURGICAL PROBLEM AT BROKEN HILL, AUSTRALIA

There was at Broken Hill, Australia, a great accumulation of about twelve million tons of tailings of former workings, containing about twenty-five per cent of the metals, zinc and lead, with some silver, but with the gangue of substantially the same weight as the metals. The ordinary process of water concentration, which depends upon the difference in the sinking power of the metallic and gangue particles, could do nothing with these tailings. The Cattermole process was devised to solve this metallurgical problem, and might have done fairly well but for the discovery of the vastly better flotation process.

The new process was successful from the beginning, and its use in Australia rapidly extended.

BRITISH AND AUSTRALIAN LITIGATION

A competitor who had failed to solve the problem immediately commenced suit, first in England against Minerals Separation, and then in Australia, against one of the licensees, charging infringement of the earlier Elmore patents. The process disclosed in these patents required from one to three tons of oil to the ton of ore. The metal particles were entrapped in a mass of oil and floated by the buoyancy of the oil. That there was no resemblance between this process and the new air bubble flotation or froth flotation process was finally decided, first by the British House of Lords in the suit commenced in England, and again by the Privy Council of the British Empire in the suit commenced in Australia.

The growth of the use of the new process was retarded by this litigation, and its introduction into use in America was not undertaken until after the favorable decision of the House of Lords.

INTRODUCTION INTO AMERICA

Edward H. Nutter, an American mining engineer and metallurgist, was appointed Chief Engineer of the American Syndicate which undertook the work of introducing the process into use in North America. Before taking up his duties he studied the process in the London laboratories of the Company, and then went to Australia to study the extensive practical use of the process there. Early in 1911, he returned to America, organized a staff of metallurgists and commenced an active and successful campaign to bring the process to the attention of mine owners.

An American corporation has recently been formed, Minerals Separation North American Corporation, incorporated under the laws of Maryland, which now owns or controls all of the patents in North America. The directors of this Company are John Ballot, one of the inventors, who has in fact been at the head of the enterprise from the beginning; Dr. S. Gregory, who has had general supervision of the work in America, and Frank Altschul, of Lazard Freres, bankers.

The process has been adopted under license from the patentees by many American mines, including the Anaconda (the greatest copper producer in the world), the Inspiration, Senator Clark's companies, the Brittannia Mining & Smelting Company, Ltd., the Portland Gold Mining Company, the Vindicator Consolidated Gold Mining Company, and scores of others. The Inspiration plant is acknowledged to be the most modern of the great copper mills, and treats about 15,000 tons of ore per day and shortly will treat nearly 20,000 tons of ore per day. The installation of the flotation process at this mine effected an initial saving of more than a million dollars in the cost of installation, and has increased the capacity of the plant to more than double that of the plant originally planned at much greater cost, and has in fact converted the Inspiration mine from a moderately profitable to an enormously profitable venture. The Anaconda Company, upon adopting the process, reorganized and very nearly reconstructed its milling plant, replacing the cumbersome machinery of former processes by the simple machines of the flotation process, and increased its recoveries from 76% to 96%, while the capacity of the mill was increased from 12,500 tons to 16,000 tons per day.

Many new problems had to be worked out in applying the process to the American copper ores, and George A. Chapman, a metallurgist of Minerals Separation, Ltd., contributed several brilliant inventions in solving these problems. He is in fact to be credited with contributing largely to the successful installation of the process at Broken Hill, Australia, and at Inspiration and Anaconda mills in the United States.

The process has also been successfully installed at, and has proved an immense benefit to the Braden mines in Chili and the El Corbe mines in Cuba and many other mines in other parts of the world.

INFRINGEMENTS AND LITIGATION

A considerable group of American companies, notably the Jackling group of mines, determined to try out flotation without reference to the rights of the patentees. The first of these operations in defiance of the patents was carried on by the Butte & Superior Copper Company of Butte, Montana, now the Butte & Superior Mining Company, one of the Jackling group. They employed James M. Hyde, a former engineer of Minerals Separation, Ltd., for this purpose. He had been given by Minerals Separation, Ltd., all information and apparatus necessary to operate the process and sent to visit various important mines in Mexico and Canada, and while in America he was specifically instructed by Minerals Separation to go to Butte, Montana, with the object of helping the Butte & Superior Company solve its metallurgical problem. Instead of doing what he was instructed to do, he returned to London and terminated his connection with the Company. Thereafter he came back to the United States and went to the mills of the Butte & Superior Company and there installed the flotation process. The

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result was the suit of Minerals Separation v. Hyde, which was commenced in October, 1911, promptly after this installation in defiance of the patents, and more than five years later, on December 11, 1916, was finally decided by the Supreme Court of the United States in favor of the patentees. This suit was commenced in the United States District Court of Montana, and was there decided favorably to the patentees by Judge George M. Bourquin of that court, in July, 1913. The defendant then appealed to the United States Circuit Court of Appeals for the Ninth Circuit, sitting at San Francisco, California, and that court reversed Judge Bourquin's decision in May, 1914, and held that the patent was void. This was believed to be a final decision against the validity of the patent, and in fact the Department of Mines then announced that this wonderful process was now free to all. There was no right ~~to~~ of appeal from this adverse decision, but the Supreme Court of the United States in exceptional cases reviews the decisions of the Circuit Court of Appeals in patent cases and the patentees succeeded in convincing the Supreme Court that this was a proper case for such review. In October, 1914, a writ of certiorari of the Supreme Court was issued, and the case was brought to that court for final determination, and argued and determined there as above noted.

A suit for infringement was also commenced against the Butte & Superior Company in 1913, but was held in abeyance awaiting the decision of the United States Supreme Court in the first suit. It will now be pressed

P. 4972, L. 17, insert "to the mining Community" after "announced"

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to final adjudication. A suit has also been carried on against Miami Copper Company, a neighbor of the Inspiration mine, who decided to add flotation without obtaining a license, shortly after the successful demonstration of that process at the Inspiration mill. This suit was tried in Wilmington, Delaware, before Judge Edward G. Bradford. The trial occupied nine weeks, from March 29, 1915, until May 27, 1915, and was decided in favor of Minerals Separation on September 29, 1916. The important new point here involved and decided in favor of Minerals Separation, Ltd., was that flotation concentration as carried on in what are known as the Callow penumatic cells, is an infringement of the Minerals Separation's patents. The patent of Minerals Separation for a frothing agent which is not an oil and is soluble in water was also included in this suit and was held to be valid and infringed. This case has been appealed to the United States Circuit Court of Appeals for the Third Circuit, sitting at Philadelphia, Pennsylvania, and the appeal has been set for argument late in January, the Miami Company having given a bond for $250,000 to stay injunction pending appeal.

A peculiar feature of the present situation is that the mines which have been licensed by Minerals Separation, Ltd., have paid small royalties and have themselves reaped enormous profits from additional recoveries largely at war prices, while the mines that have proceeded in defiance of the patents have run the risk of judgment against them for all of their additional profit, including their enormous war profits, attributal to the invention. The rule of law is that an infringer is to be treated as a trustee for the owner of the patent, and must account to the owner of the patent for all profits due to the invention. Further it is a fundamental principle of patent law that no one is permitted to use a patented invention without the consent of the patentees, and now that the basic patent has been finally sustained by the Supreme Court of the United States it is not to be expected that the patentees will permit the continuance of further operations in defiance of their patents.

Henry D. Williams, patent lawyer, of New York City, has conducted all of the American litigation from the beginning. William H. Kenyon of Kenyon & Kenyon, also of New York City, has been associated with him during the past two and a half years. In the Wilmington suit Thomas F. Bayard, son of late Ambassador and Secretary of State Bayard, is associate counsel. In the United States Supreme Court Lindley M. Garrison, now of New York, formerly Vice-Chancellor of New Jersey and later Secretary of War, and Frederic D. McKenney of Washington, D. C., are associate counsel. Odell W. McConnell of Helena, Montana, and John H. Miller of San Francisco, California, have also contributed their assistance in Montana and California in the efforts to sustain the patents and secure to the inventors that protection and reward guaranteed by our patent laws. It is to be remembered that these laws, like the copyright laws, were en-

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acted pursuant to the clause of the Constitution of the United States empowering Congress, "to promote the progress of science and useful arts by securing for limited times to authors and inventors the exclusive right to their respective writings and discoveries."

POLICY OF MINERALS SEPARATION

The policy of Minerals Separation has always been, aside from its own use of its process, to license the use of its process to all who wished to use it, and to give to its licensees the full benefit of all its experience, research and knowledge, and to receive as compensation a reasonable royalty based upon material treated or values recovered by its process. Thus its compensation is based only upon the extent of the use of its process, and is quite analogous to the royalty of an author or playwright. Royalty to inventor is as much a matter of equity and good conscience as is royalty to authors. Piracy of inventions is as reprehensible as piracy of literary work.

This policy of Minerals Separation has not met with serious opposition in any part of the world except the United States. Here it has been necessary to fight to the finish to establish its rights as against many of the users of its process. Abroad it was only necessary to fight an unsuccessful competitor.

SUMMARY OF ADJUDICATIONS

Out of all this litigation have come adjudications by the three greatest courts in the world as to the novelty of the froth flotation process. These courts are the Supreme Court of the United States, the British House of Lords, and the Privy Council of the British Empire, the latter being a court composed in each instance of a committee appointed by the Lord Chancellor from the Law Lords of the House of Lords. In the Minerals Separation case, Viscount Haldane appointed a committee of five, including himself. The House of Lords' decision was rendered by five other Law Lords, including the then Lord Chancellor, Lord Loreburn, and the Supreme Court decision was given unanimously by the full bench of nine justices. Thus the judgments and decisions express the conclusions of nineteen of the greatest jurists in the world. It is pleasing to note that the opinions of Judge Bourquin of Butte, Montana, and Judge Bradford, of Wilmington, Delaware, are in harmony with these great courts and were in fact followed by the Supreme Court of the United States. It is believed that the legal battle as to the rights of the inventors is now substantially completed.

ADJUDICATIONS AS TO THE NOVELTY OF THE INVENTION

It has been repeatedly stated in the literature of flotation that Carrie J. Everson was the inventor of flotation. The fact is that her patent of 1886, discloses a metal-sinking process, in which the metallic particles are mixed with enough oil to make them lighter than gangue, but still heavier than water, and are separated

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in suspension by reason of the fact that they do not sink as fast as the gangue. To use her own words: "The sand and mineral are merely transposed or their relative positions are reversed, because the sand is heavier than the mixture of mineral, oil and acid."

Her patent has now been considered both by the House of Lords and the Supreme Court of the United States, and the Supreme Court of the United States has agreed with the House of Lords that her patent does not disclose flotation. The following is an excerpt from the Supreme Court decision:

"It is not necessary for us to go into a detailed examination of the process in suit to distinguish it from the processes of the patents relied on as anticipations, convinced as we are that the small amount of oil used makes it clear that the lifting force that separates the metallic particles of the pulp from the other substances of it is not to be found principally in the buoyancy of the oil used, as was the case in prior processes, but that this force is to be found, chiefly, in the buoyancy of the air bubbles introduced into the mixture by an agitation greater than, and different from, that which had been resorted to before and that this advance on the prior art and the resulting froth concentrate so different from the product of other processes make of it a patentable discovery as new and original as it has proved useful and economical. It results without more discussion that we fully agree with the decision of the House of Lords, arrived at upon a different record and with different witnesses, but when dealing with the equivalent of the patent in suit, in Minerals Separation, Limited, v. British Ore Concentration Syndicate, Limited, 27 R. P. C. 33. In this decision Lord Shaw, speaking for the court and distinguishing the process there in suit especially from the Elmore oil flotation process which had gone before, but which was typical of the then prior art said: "They (the patentees of the Agitation Froth Process of the patent in suit) are not promoting a method of separation which had before been described, but they are engaged upon a new method of separation. Instead of relying upon the lesser specific gravity of oil in bulk they rely upon the production of a froth by means of an agitation which not only assists the process of the minute quantities of oil reaching the minute particles of metal, but forms a multitude of air cells, the buoyancy of which air cells, forming around single particles of the metal, floats them to the surface of the liquid."

"And Lord Atkinson said: 'In their process this mysterious affinity of oil for the metallic particles of the ore is availed of, yet the oil is used in such relatively infinitesimal quantities, that the metallic particles are only coated with a thin film of it, and the lifting force is found not in the natural buoyancy of the mass of added oil, but in the buouancy of the air bubbles, which, introduced into the mixture by the more or less violent agitation of it, enveloped or becomes attached to, the thinly oiled metallic particles, and raise them to the surface, where they are maintained by what is styled the surface tension of the water.'

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"The record shows not only that the process in suit was promptly considered by the patentees as an original and important discovery, but that it was immediately generally accepted as so great an advance over any process known before that, without puffing or other business exploitation, it promptly came into extensive use for the concentration of ores in most, if not all, of the principal mining companies of the world, notably in the United States, Australia, Sweden, Chile and Cuba, and that, because of its economy and simplicity, it has largely replaced all earlier processes. This, of itself, is persuasive evidence of that invention which it is the purpose of the patent laws to reward and protect."

The Supreme Court of the United States and the Privy Council of the British Empire, have both considered the Criley and Everson publication in the Engineering and Mining Journal of 1890. The Privy Council said that their attention had been directed in considerable detail to this article and they found it so incomplete that it was not even sufficient to anticipate the Elmore patent (although the House of Lords had held the British Elmore patent anticipated by the Everson patent). They said of it:

"Even if the test process is not to be discarded as a failure, it does no more than give information that if to a greased mixture of pulverized metal and rock you add boiling sulphuric acid in sufficient quantity, in some way a differentiation is effected as between the metal and the gangue."

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To Carrie J. Everson is to be given the credit of having first discovered that in a process where oil is used to entrap the metal of an ore pulp and add buoyancy to it, an acid such as sulphuric acid will help to keep the oil off the gangue. In her patent she did not add enough oil to make the metal float. In what is described in the publication above referred to she may have done so, but the publication itself does not establish ~~the~~ that fact. If she did, she completely anticipated the Elmore oil-buoyancy metal-flotation process, but ~~wha~~t was no nearer the froth flotation process than was Elmore with his minimum of ~~one~~ a ton of oil to a ton of ore.

The other prior patents which have been relied upon to anticipate the froth flotation process are all disposed of by the decision of the Supreme Court of the United States. As that court says of all prior processes, including Everson:—

"All of which, speaking broadly, consisted in mixing finely crushed or powdered ore with water and oil * * * and then in variously treating the mass—the pulp—thus formed so as to separate the oil, when it became impregnated or loaded with the metal and metal-bearing particles, from the valueless gangue."

As otherwise expressed in the decision, before the froth flotation process was invented, oil was loaded with metal, and either floated the metal, as in Elmore, by what the Supreme Court calls the "Surface Flotation Process," or sank the metal, as in Cattermole, by what the Supreme Court call the "Metal Sink-

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ing Process". Everson, so far as disclosed in the patent, comes wi~~l~~thin the latter class.

As contrasted with the utilization of oil as a buoyant agent or as an agglutinating agent, the froth flotation process utilizes air bubbles as the buoyant agent and only utilizes oil to modify the air bubbles and make them persistent and increase their adherence to the metallic particles. The oil disappears from sight and touch, and the apparatus, except at the point of the introduction of the oil, remains as clean and as free from oil as though no oil were ~~was~~ used.

In Australia Minerals Separation and licensed users have produced by flotation over 1,800,000 tons of zinc, 350,000 tons of lead, and 40,000,000 ounces of silver.

EXTENT OF USE OF THE INVENTION

The following are among the principal licensees under Minerals Separation patents in North America:

Atlas Mining & Milling Co.
M. W. Atwater.
Anaconda Copper Mining Co.
Arizona Copper Co., Ltd.
Britannia Mining & Smelting Co., Ltd.
Burro Mountain Copper Co.
Broadwater Mills Co.
Brockmann & Co., Inc.
Cuba Copper Co.
Cusi Mining Co.
Consolidated Arizona Smelting Co.
Chicagoff Mining Co.

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Doe Run Lead Co.
Desloge Consolidated Lead Co.
Dutch-Sweeney Mining Co.
Engels Copper Mining Co.
Flint Mines, Ltd.
Greene-Cananea Copper Co.
Highland Valley Mining & Dev. Co.
Inspiration Cons. Copper Co.
Mountain Copper Co., Ltd.
Mond Nickel Co., Ltd.
Mineral Recovery Co.
Old Dom. Cop. Mining & Smelting Co.
Pingrey Mines & Ore Reduction Co.
Phelps, Dodge & Co.
Portland Gold Mining Co.
Reward Gold Mines Co.
St. Joseph Lead Co.
Timber Butte Milling Co.
Utah Leasing Co.
Vindicator Cons. Gold Mining Co.
Weedon Mining Co., Ltd.

In North America, and principally in the United States, the use of the process has been carried on both by licensees and infringers. It is estimated that over 1,000,000 tons of ore were treated by the process during 1914, 5,000,000 tons during 1915, and about 25,000,000 tons during 1916.

In South America the Braden Copper Co. is the largest user of the Minerals Separation flotation pro-

Defendant's Exhibit 25.

cess. The Cerro de Pasco Mining Co., Corocoro United Copper Mines, Ltd., and the Societe des Mines de Cuivre de Caternau are also South American licensees.

There are also several licensees in Europe, but no statistics are available because of the war.

Filed May 18, 1917.

GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Defendant's Exhibit 25.

Admitted.

HENRY D. WILLIAMS.
Attorney and Counsellor at Law.
Solicitor of Patents
61 Broadway (Adams Building)

New York, January 30, 1917.

Utah Copper Company,
600 McCormick Building,
Salt Lake City, Utah.

Gentlemen:

In behalf of my clients, Minerals Separation, Limited, of London, England, and Minerals Separation North American Corporation of 61 Broadway, New York, N. Y., you are hereby notified of infringement of my clients' patents for froth flotation concentration of ores, and particularly the basic patent for such a process, No. 835,120, issued November 6, 1906, to Sulman, Picard and Ballot, recently held to be valid

Defendant's Exhibit 25.

and infringed by the Supreme Court of the United States in the case of Minerals Separation, Ltd., and another against Hyde. I am enclosing a copy of the opinion and order of the Supreme Court and of the decree and injunction affirmed thereby with immaterial modifications. My clients are willing to grant licenses to those who wish to use their inventions, but before any consideration can be given to that matter, a full settlement for past infringements must be made, and this altogether regardless of whether or not you wish to continue to use flotation.

You are therefore hereby directed to send to me a full statement of your infringing operations in accordance with the interrogatories enclosed herewith, in default whereof I am directed to commence suit against you for an injunction, profits and damages, including a preliminary injunction at the commencement of the suit to immediately stop your infringing operations.

Yours etc.,

(Signed) Henry D. Williams.

2 encs.

Enclosed in letter from John M. Hays dated Feb. 7, 1917.

STATEMENT OF FLOTATION OPERATIONS

1. Name of Company
2. Where incorporated
3. Home office address

Defendant's Exhibit 25.

4. Name of Mine
5. Mine address
6. (a) Is mine in operation
   (b) Is mill in operation
7. (a) Present daily tonnage
   (b) Expected daily tonnage
8. General character of ore
9. Principal sulphide minerals
10. Principal gangue minerals
11. Type and daily capacity of milling plant
12. (a) Is the flotation process in use or has it been used, experimentally or otherwise, in this mill
    (b) For how long
13. What products are or have been treated by flotation
14. What is the total mill recovery
15. What proportion of total recovery is due to flotation
16. Number of tons treated daily by flotation
17. Total tonnage treated by flotation to date
18. Total concentrates produced by flotation to date
19. Average assay value of flotation concentrates
20. Gross market value of all flotation concentrates produced to date in this mill
21. Type and manufacture of flotation apparatus used in this mill
22. (a) Have any flotation tests been made on this ore
    (b) If so, by whom

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23. On separate sheet, give complete details of flotation tests made

24. Remarks

Dated

Signed

Title

B

Filed May 18, 1917.

GEO. W. SPROULE, Clerk.

By H. H. WALKER, Deputy.

Defendant's Exhibit No. 26.

Record of Flotation Operations on the Retreatment of Vanner Concentrate

Date	FLOTATION HEADINGS Weight Dry Tons	FLOTATION HEADINGS Average Daily Tonnage	FLOTATION HEADINGS Assay Percent Copper	FLOT. CONCTS. Weight Dry Tons	FLOT. CONCTS. Assay Percent Copper	Flot. Tails Assay Percent Copper	% Indicated Recovery	Initial Oil Pounds Per Ton	Other Re-Agents Pounds Per Ton
1914									
Dec. 8 to 31	2,003	105	13.19	588	42.87	.959	94.851	2.45	Nil
1915									
1st Quarter	12,531	139	12.62	3,512	41.30	.776	95.648	2.87	1.30
2d "	26,496	291	9.64	6,312	37.76	1.362	89.084	1.54	.292
3d "	31,781	345	7.33	6,687	31.69	.850	90.812	1.48	.594
4th "	24,587	267	6.47	4,713	32.29	.581	92.688	2.18	2.350
Year 1915	95,395	261	9.02	21,223	35.99	.89	92.42	2.01	.900
1916									
1st Quarter	26,800	298	6.17	6,601	24.14	.392	95.193	5.95	3.629
2nd "	26,329	286	7.12	6,099	29.78	.391	95.766	10.97	6.191
3d "	26,804	291	7.01	6,804	27.10	.306	96.717	8.76	4.570
Oct. 1916	9,794	316	7.77	2,884	26.03	.20	98.17	10.26	4.768
Nov. 18, 19, 20	561	187	10.24	190	29.28	.244	98.437	23.70	6.338
Nov. 1916	8,444	281	7.78	2,612	23.91	.32	97.19	13.71	4.774
Dec. 1 to 20	5,570	279	8.48	2,099	21.62	.412	96.989	12.39	4.398
Dec. 21 to 31	2,130	194	9.24	948	20.37	.332	98.004	24.57	6.178
Dec. 1916	7,800	252	8.79	3,046	21.48	.39	97.33	16.77	4.86
4th Quarter	26,047	283	8.08	8,542	23.76	.292	97.585	13.33	4.798
Year 1916	105,980	290	7.14	28,045	26.52	.35	96.37	10.24	4.791
1917									
January	6,518	210	8.09	2,259	23.24	.29	97.63	21.10	6.458
February	5,614	201	7.64	2,030	21.29	.29	97.53	21.70	6.753
March	8,265	267	5.23	2,230	18.49	.39	94.54	23.73	6.348
1st Quarter	20,397	227	6.81	6,519	21.01	.32	96.77	22.18	6.520
Dec. 8, 1914 to Dec. 20, 1916	201,139	272	8.04	48,870	30.61	.48	95.528	5.98	4.190
Dec. 21, 1916 to Mar. 31, 1917	22,536	223	7.04	7,467	20.93	.32	96.936	23.38	6.349
All Operations up to Mar. 31, 1917	223,775	266	7.97	56,375	29.62	.632	94.078	9.219	2.053

Hurley 4/2/17

Copied Butte 4/15/17

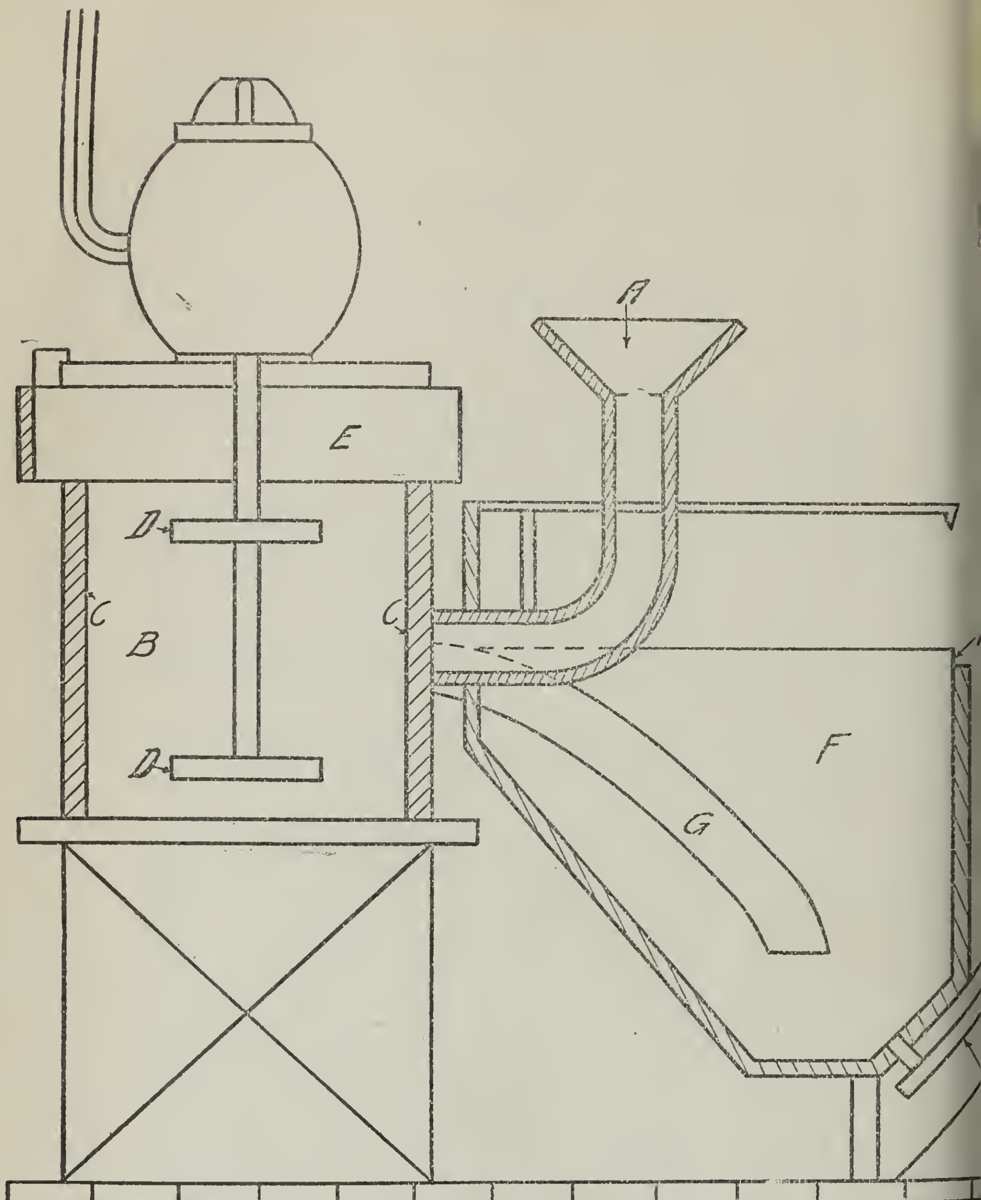
(Signed) F. R. WICKS

Asst. Supt. of Mills.

Filed May 18, 1917. GEO. W. SPROULE, Clerk.

By H. H. WALKER, Deputy.

Defendant's Exhibit No. 27.



Filed May 18, 1917. GEO. W. SPROULE. Clerk.
By H. H. WALKER. Deputy

P. 4988, insert on drawing marked " Defendant's Exhibit No. 27," the following : " Tube I regulates liquid level and should extend up to liquid level."

Defendant's Exhibit No. 28.

Record of Flotation Operations On the Treatment of Slime Vanner Tailings

Date	FLOTATION HEADINGS Weight Dry Tons	Average Daily Tonnage	Assay Percent Copper	FLO. CONCTS. Weight Dry Tons	Assay Percent Copper	Flotation Tails Assay Percent Copper	% Indicated Recovery	Initial Oil Pounds Per Ton	Other Reagents Pounds Per Ton	Oil In Circu'g Load Lbs. Per Ton	Total Oil Pounds Per Ton	Kind of Oil Used
1915												
Apr. 16-30	8600	410	.96	157	12.78	.74	24.33	.85				
May 1-25	27750	1110	.93	495	11.14	.73	23.01	1.08				
June	None											
July 13-23	8065	733	.74	434	4.90	.54	30.37	1.45				
3d Quarter	90104	979	.72	1355	16.93	.47	35.35	1.20				
4th "	299522	3256	.78	20842	23.08	.54	35.72	1.02				
Year 1915	434041	1189	.798	23283	22.060	.540	33.14	1.04				
1st Quarter	288320	3168	.88	3915	21.27	.67	25.92	1.04				
2d "	280424	3048	.79	2846	27.03	.54	33.43	1.45				
3d "	328120	3566	.86	3516	28.07	.53	35.94	1.33				
4th "	352810	3835	.82	3668	29.53	.52	37.59	.96				
Year 1916	1249674	3414	.84	13945	26.48	.56	33.27	1.19				
Jan. 1917	127350	4108	.75	1204	31.89	.45	40.49	1.10				
Feb. 1917	124900	4461	.78	1177	28.78	.51	35.23	.53				
Mar. 1917	136170	4393	.71	1453	25.22	.44	37.89	1.46				
1st Quatrer	388420	4269	.75	3834	28.63	.47	37.87	1.03				
Aver. of All Operations to Date	2072135	2999	.814	41062	24.175	.539	34.553	1.13				
1917												
Jan. 7	2058		.98		22.47	.78	24.07	9.72		*2.43	12.15	Jones
Mar. 13	205		.67		9.10	.53	25.50	24.19				Stove
Mar. 14	122		.80		27.60	.48	41.00	22.80				Coal Tar
Mar. 21	135		.69		25.10	.44	37.00	37.79				& Stove
Mar. 27	2300		.63		11.73	.41	36.20	32.27				Taft
Apr. 2	1700		.61		14.87	.43	30.40	10.54				Sulphur
Apr. 2	1965		.65		14.87	.48	27.00	.34				
Apr. 4	3250		.57		25.73	.40	30.30	8.10		3.2	11.3	

*Approximate quantity.

Hurley 4/10/17
Copied Butte 4/15/17

(Signed) O. WISER
Metallurgical Engineer.

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Defendant's Exhibit No. 29.

CHINO COPPER COMPANY
HURLEY PLANT
Record of Flotation Operations On the Retreatment of Vanner Concentrates

DATE	FLOTATION HEADINGS Weight Dry Tons	FLOTATION HEADINGS Average Daily Tonnage	FLOTATION HEADINGS Assay Percent Copper	FLOTATION CONCTS. Weight Dry Tons	FLOTATION CONCTS. Assay Percent Copper	FLO. TAILS Assay Percent Copper	% Indicated Recovery	Initial Oil Pounds Per Ton	Other Re-Agents Pounds Per Ton
1914									
Dec. 8 to 31	2,003	105	13.19	588	42.87	.959	94.851	2.45	Nil
1915									
1st Quarter	12,531	139	12.62	3,512	41.30	.776	95.648	2.87	.130
2nd Quarter	26,496	291	9.64	6,312	37.76	1.362	89.084	1.54	.292
3rd Quarter	31,781	345	7.33	6,687	31.69	.850	90.812	1.48	.594
4th Quarter	24,587	267	6.47	4,713	32.29	.581	92.688	2.18	2.350
Year 1915	95,395	261	9.02	21,223	35.99	.89	92.42	2.01	.900
1916									
1st Quarter	26,800	298	6.17	6,601	24.14	.392	95.193	5.95	3.629
2nd Quarter	26,329	286	7.12	6,099	29.78	.391	95.766	10.97	6.191
3rd Quarter	26,804	291	7.01	6,804	27.10	.306	96.717	8.76	4.570
Oct. 1916	9,794	316	7.77	2,884	26.03	.20	98.17	10.26	4.768
Nov. 18, 19, 20	561	187	10.24	190	29.28	.244	98.437	23.70	6.338
Nov. 1916	8,444	281	7.78	2,612	23.91	.32	97.19	13.71	4.774
Dec. 1 to 20	5,570	279	8.48	2,099	21.62	.412	96.989	12.39	4.398
Dec. 21 to 31	2,139	194	9.24	948	20.37	.332	98.004	24.57	6.178
Dec. 1916	7,809	252	8.79	3,046	21.48	.39	97.33	16.77	4.86
4th Quarter	26,047	283	8.08	8,542	23.76	.292	97.585	13.33	4.798
Year 1916	105,980	290	7.14	28,045	26.52	.35	96.37	10.24	4.791
1917									
January	6,518	210	8.09	2,259	23.24	.29	97.63	21.10	6.458
February	5,614	201	7.64	2,030	21.29	.29	97.53	21.70	6.753
March	8,265	267	5.23	2,230	18.49	.39	94.54	23.73	6.348
1st Quarter	20,397	227	6.81	6,519	21.01	.32	96.77	22.18	6.520
Dec. 8, 1914 to Dec. 20, 1916	201,139	272	8.04	48,876	30.61	.48	95.528	5.98	4.190
Dec. 21, 1916 to Mar. 31, 1917	22,536	223	7.01	7,467	20.93	.32	96.936	23.38	6.349
All operations up to Mar. 31, 1917	223,775	266	7.97	56,375	29.62	.632	94.078	9.219	2.053

Hurley, N. Mex.
April 2, 1917.

(Signed) F. R. WICKS
Asst. Sup. of Mill

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Defendant

UTAH COPPER

Flotation Retreatment Plant R

February 1, 191

Month	Estimated Tons Treated	HEADING Cu.	Fe.	Insol.	Tailing
1915					
Feb.	10,204	9.320	6.97	72.44	.370
March	12,016	8.087	7.21	72.13	.419
April	14,150	7.200	7.48	73.16	.260
May	16,252	8.850	7.34	71.38	.250
June	16,847	7.380	7.06	72.78	.330
July	17,716	8.650	7.76	69.93	.570
August	17,664	10.050	7.38	69.10	.560
Sept.	16,605	8.914	8.49	67.33	.549
October	16,547	9.162	6.68	71.82	.300
November	16,405	8.831	8.22	68.99	.219
December	15,719	8.487	6.90	72.54	.409
1916					
January	14,213	8.114	5.60	74.79	.259
February	13,403	7.053	5.43	76.61	.301
March	15,799	6.041	5.03	79.65	.316
April	17,331	6.034	5.02	78.23	.354
May	20,334	7.107	6.18	75.14	.365
June	24,759	6.811	6.83	73.28	.381
July	26,024	6.899	6.03	75.79	.471
August	27,436	7.104	7.26	73.29	.357
Sept.	27,183	7.219	6.57	74.38	.338
October	25,918	7.150	6.21	74.54	.275
November	23,685	6.751	6.73	73.96	.284
Dec. 1 to 21, incl.	14,076	6.749	5.99	75.12	.380
Total	420,285				
Average		7.625	6.70	73.43	.361

USING 20 POUNDS OF

Month	Tons Treated	HEADING Cu.	Fe.	Insol.	Tailing	To Co Prod
Dec. 22 to 31, incl.	2,321	4.908	3.98	81.82	.199	43
1917						
January	17,905	5.288	5.14	78.77	.172	385
February	17,962	5.806	5.81	76.59	.223	445
March	19,937	5.189	6.04	77.22	.228	486
April 1-8	5,051	4.928	6.89	76.39	*.586	122
Total	63,176					1483
Average		5.361	5.71	77.58	.238	

* The high tailing obtained from April 1st to 8th, 1917, inclusive, was due to
One machine in operation February 1st, 1915 to July 11th, 1916, inclusive.
Two machines in operation July 12th, 1916 to April 8th, 1917, inclusive.

Arthur, Utah.
April 21, 1917.

Copied Aug. 13th, 1917.
Butte, Mont.--MCD

Filed May 18, 1917 GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy

ibit No. 30.

Y—ARTHUR PLANT

eating Mineral Classifier Overflow

l 8, 1917—Inclusive

CONCENTRATE			%	Ratio	POUNDS PER TON		Per Cent
Cu.	Fe.	Insol.	Ind. Ext'n	Conct.	Oil	Reagents	Solids
30.760	19.78	16.46	97.20	3.40	2.27	4.68	42.30
27.248	22.04	16.00	96.30	3.50	1.54	5.85	41.29
25.890	23.79	16.02	97.37	3.69	1.64	9.51	38.44
28.920	21.13	15.82	98.02	3.33	1.83	2.83	37.95
28.230	20.32	18.22	96.66	3.96	1.90	2.34	40.56
25.580	20.70	19.65	95.54	3.10	2.88	1.98	28.80
29.070	18.67	19.37	96.28	3.00	2.48	2.43	26.85
25.032	20.71	19.91	95.94	2.93	3.19	2.07	28.14
30.571	19.67	16.29	97.69	3.42	8.94	1.89	23.09
28.186	21.33	15.75	98.28	3.25	4.25	2.39	25.89
28.775	20.40	16.19	96.55	3.51	3.50	2.94	24.94
32.025	19.12	15.33	97.60	4.04	4.34	2.03	20.37
30.190	20.69	14.45	96.69	4.43	4.26	2.64	19.41
28.304	22.08	14.55	95.84	4.89	3.61	2.32	25.24
26.746	21.60	16.77	95.40	4.65	3.21	2.95	24.59
26.254	21.88	17.48	96.20	3.84	2.66	3.98	24.63
23.285	23.07	18.25	95.97	3.56	2.71	3.65	25.45
23.828	20.88	21.98	95.05	3.63	3.67	4.51	22.68
24.305	22.50	18.25	96.39	3.55	4.42	5.25	23.87
25.615	22.71	16.62	96.59	3.67	4.84	5.27	29.15
27.030	22.53	15.32	97.14	3.89	5.00	7.25	32.86
25.173	24.24	15.18	96.89	3.85	5.52	7.09	31.52
25.355	22.90	19.16	95.80	3.92	5.21	7.21	27.44
26.800	21.53	17.34	96.57	3.64	3.76	4.05	28.43

R TON OF ORE TREATED

CONCENTRATE			%	Ratio	POUNDS PER TON				Per Cent
					OILS				
ı.	Fe.	Insol.	Ind. Ext'n	Conct.	New	Circ.	Total	Reagents	Solids
2713	19.38	21.75	96.69	5.36	23.95		23.95	9.90	26.00
2153	21.58	18.85	97.44	4.64	19.73	1.02	20.75	5.04	28.94
2733	20.76	22.58	97.11	4.03	15.39	2.91	18.30	5.51	29.09
2712	22.09	21.70	96.67	4.10	15.33	4.93	20.26	6.35	30.71
1546	21.99	22.36	90.98	4.14	39.13	6.26	45.39	7.40	29.13
2180	21.47	21.28	96.60	4.28	18.81	3.17	21.98	5.96	29.45

e experimenting with oils.

Defendant's Exhibit

UTAH COPPER COMPANY—A

EXPERIMENTAL AND RESEAR

Summary of Results Obtained from Commercial Exp

Exp. No.	Hours Duration	HEADING Dry Tons	HEADING % Cu.	HEADING % Fe.	HEADING % Insol.	TAILING Dry Tons	TAILING % Cu.	CONCENTRATE Dry Tons	CONCENTRATE % Cu.	CONCENTRATE % Fe.	CONCENTRATE Insol.	Ratio Conct.	% Ind. Ext's	% Solids in Feed	Tons Circ. Feed
								USING 59% SMELTER FUEL, 30% JONES, 10% AMERIC							
1	8	151	4.500	7.40	76.20	124.7	1.577	26.3	18.325	28.10	11.90	5.73	71.07	30.35	23
2	24	638	4.700	6.53	77.20	502.3	1.066	135.7	18.158	25.75	16.28	4.70	82.14	30.94	82
3	24	594	4.216	6.60	75.93	452.2	.456	141.8	16.209	25.33	17.78	4.19	92.43	28.69	102
4	24	697	5.433	6.03	75.80	523.3	.324	173.7	20.818	22.87	20.14	4.01	95.52	30.25	114
5	24	652	4.700	6.97	76.53	490.7	.226	161.3	18.321	25.81	16.51	4.04	96.38	28.40	110
6	24	627	4.733	6.87	76.20	471.8	.141	155.2	18.692	24.50	18.77	4.04	97.76	27.65	89
7	24	597	3.833	6.27	79.00	478.1	.076	118.9	18.950	23.69	19.39	5.02	98.41	26.43	75
8	16	278	4.00	5.65	80.20	213.2	.251	64.8	16.325	24.95	17.40	4.29	95.19	17.45	51
9	24	731	4.166	7.10	74.40	553.1	.119	177.9	16.764	22.26	23.20	4.11	97.84	33.11	106
10	16	438	3.900	6.95	75.60	323.3	.100	114.7	14.600	24.93	21.83	3.82	98.11	26.83	58
11	24	572	4.500	7.30	75.47	425.7	.166	146.3	17.099	22.14	22.24	3.91	97.26	27.24	74
12	24	693	5.933	6.80	75.00	473.7	.268	219.3	18.169	18.87	27.62	3.16	96.91	29.94	92
13	24	643	5.300	7.53	76.53	452.8	.272	190.2	17.250	19.61	25.76	3.38	96.39	31.23	123
										USING 91% AMERICAN CREOSOTE NO					
14	2	53	4.500	7.50	77.60	49.0	3.433	4.0	17.400	25.80	16.20	13.09	29.54	27.04	6
15	8	218	5.100	6.40	77.20	186.5	2.460	31.5	20.700	26.15	14.00	6.91	58.75	30.18	46
16	8	244	5.600	7.40	75.80	185.6	.740	58.4	21.050	27.30	10.40	4.18	89.95	31.09	32
17	8	181	4.500	8.00	76.20	143.5	.810	37.5	18.650	27.87	12.20	4.83	85.72	23.64	21
18	4	120	5.500	6.20	76.60	106.5	3.502	13.5	21.250	25.85	16.25	8.88	43.49	30.15	16
19	4	147	5.950	5.50	76.80	114.8	1.217	32.2	22.850	24.40	16.00	4.57	84.02	28.57	22
											USING 60% SMELTER FUEL A				
20	24	628	4.716	5.86	78.46	478.5	.306	149.5	18.812	19.69	26.13	4.20	95.06	26.70	

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

t No. 31.

ARTHUR PLANT
CH DEPARTMENT

periments on Low Grade Concentrate

Tons Total Feed	POUNDS NEW OIL ADDED Total Pounds	Per Ton New Feed	Per Ton Total Feed	CIRCULATING OIL Total Lbs.	Per Ton New Feed	Per Ton Total Feed	TOTAL NEW AND CIRCULATING OIL Total Pounds	Per Ton New Feed	Per Ton Total Feed	FLOW CELLS To Bins	To Circ.	REAGENTS Total Pounds	Pounds Per Ton
AN CREOSOTE NO. 2, 1% YARYAN PINE													
174	242	1.60	1.39	953	6.31	5.48	1195	7.91	6.87	7	21	1532	10.14
720	2394	3.75	3.33	3951	6.19	5.49	6345	9.94	8.82	6	22	5796	9.08
696	4419	7.44	6.35	3869	6.51	5.56	8288	13.95	11.91	7	21	4288	7.22
811	6863	9.85	8.46	4920	7.06	6.07	11783	16.91	14.53	9	19	4824	6.92
762	8031	12.32	10.54	4579	7.02	6.01	12610	19.34	16.55	7	21	3752	5.75
716	9418	15.02	13.15	5596	8.93	7.82	15014	23.95	20.97	7	21	3752	5.98
672	12133	20.33	18.06	5000	8.37	7.44	17133	28.70	25.50	6	22	3216	5.39
329	9210	33.13	27.99	2514	9.04	7.64	11724	42.17	35.63	7	21	3828	13.77
837	26614	36.41	31.80	3896	5.33	4.65	30510	41.74	36.45	12	16	6331	11.07
496	15514	35.42	31.28	2694	6.15	5.43	18208	41.57	36.71	8	20	4829	11.03
646	34060	59.55	52.72	4311	7.53	6.67	38371	67.08	59.39	10	18	6331	11.07
785	45008	64.95	57.33	5172	7.46	6.59	50180	72.41	63.92	14	14	3885	5.61
766	66512	103.44	86.83	7375	11.47	9.63	73887	114.91	96.46	12	16	6364	9.90
. 2 AND 9% YARYAN PINE								Refer to Exp.					
59	36	.68	.61							1 9	19	368	6.94
264	213	.98	.81							3 9	19	1398	6.41
276	364	1.49	1.32							4 7	21	1205	4.94
202	356	1.97	1.76							5 11	17	1282	7.08
136	129	1.08	.95	151	1.25	1.11	280	2.33	2.06	6 8	20	636	5.30
169	261	1.78	1.54	343	2.33	2.03	604	4.11	3.57	8 8	20	777	5.29
ND 40% JONES OIL													
	11206	17.84								28		3885	6.19

Defendant's Exhibit No. 32.

UTAH COPPER COMPANY—ARTHUR PLANT
EXPERIMENTAL AND RESEARCH DEPARTMENT

Summary of Returns Obtained from Commercial Experiments On Slime Feed

		HEADING		TAILING		CONCENTRATE						POUNDS PER TON		
Exp. No.	Hours Duration	Dry Tons	% Cu.	Dry Tons	% Cu.	Dry Tons	% Cu.	% Fe.	% Insol.	Ind. Ext'n	Ratio Conct.	Oil	Acid	
USING 98 PERCENT { 60 Per Cent 34° Paraffine Base Distillate, 40 Per Cent Gilsonite } 2 Per Cent { 95 Per Cent Barrett No. 4 Creosote, 5 Per Cent Yaryan Pine }														
21	8	284.0	1.430	268.2	.180	15.8	22.600	14.50	34.20	88.11	17.94	10.15	7.42	
22	8	238.0	1.045	230.1	.475	7.9	17.700	13.800	38.00	56.05	30.22	11.36	7.44	
23	8	252.0	1.485	234.4	.310	17.6	17.100	12.80	39.60	80.59	14.29	15.32	6.67	
24	8	230.0	.970	221.3	.180	8.7	21.000	16.50	29.00	82.15	26.35	20.19	8.46	
25	24	611.0	1.030	576.1	.180	34.9	15.433	14.66	40.00	83.83	17.53	20.69	8.11	
26	8	174.0	.980	166.3	.170	7.7	18.500	18.10	31.20	83.42	22.63	39.26	17.33	
27	8	260.0	.700	250.8	.110	9.4	16.400	12.70	42.00	84.85	27.61	56.93	6.46	
28	4	137.5	.940	129.4	.100	8.1	14.300	8.90	50.90	89.99	16.90	78.40	7.40	
29	4	137.5	1.060	128.7	.110	8.8	15.000	12.40	44.00	90.28	15.67	99.43	7.40	
USING { 95 Per Cent Barrett No. 4 Creosote, 5 Per Cent Yaryan Pine }														
30	16	526.0	1.085	516.9	.995	9.1	6.200	6.30	69.70	9.88	57.83	.48	5.62	Refer to Experiment No. 25
31	8	307.0	1.020	305.4	1.015	.6	3.450	5.00	74.60	.69	487.00	.53	6.20	" " " " 26
32	8	202.0	.875	194.4	.760	7.6	3.800	5.40	74.40	16.46	26.43	.95	10.43	" " " " 27
33	8	205.0	.790	204.9	.780	.1	17.200	12.00	44.00	1.33	1642.00	1.57	9.26	" " " " 28

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

T. A. JANNEY.
ORE CONCENTRATING APPARATUS.
APPLICATION FILED AUG. 10, 1914.

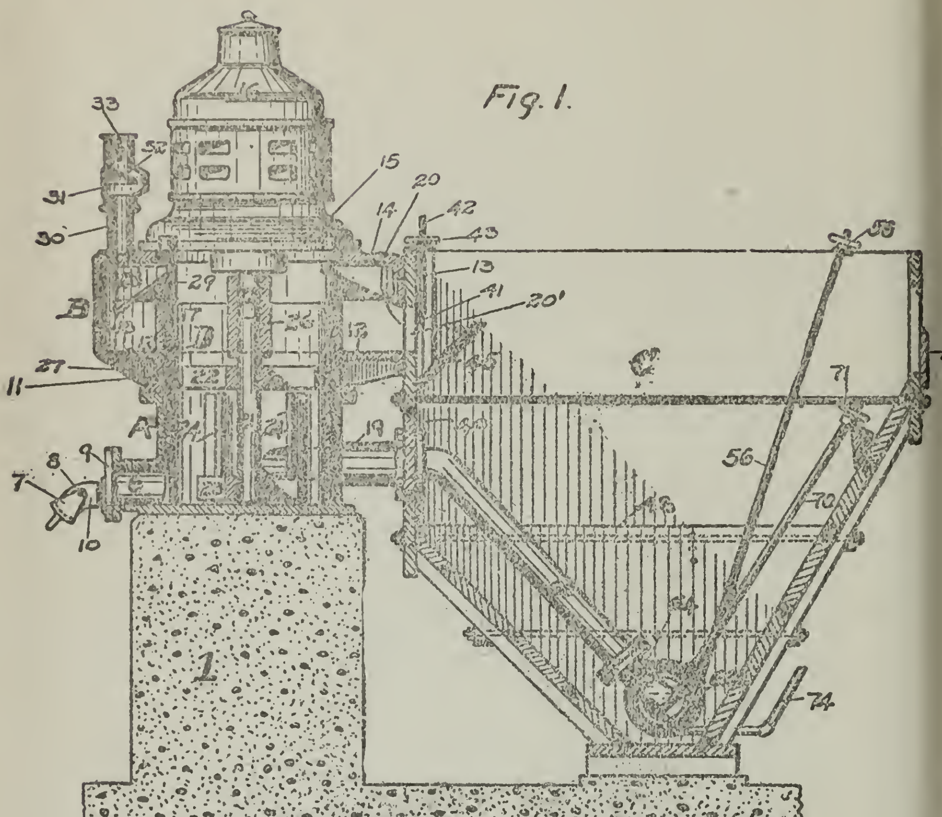
Pltff's Ex. No.

1,167,076.

Patented Jan. 4, 191

3 SHEETS—SHEET 1

Fig. 1.



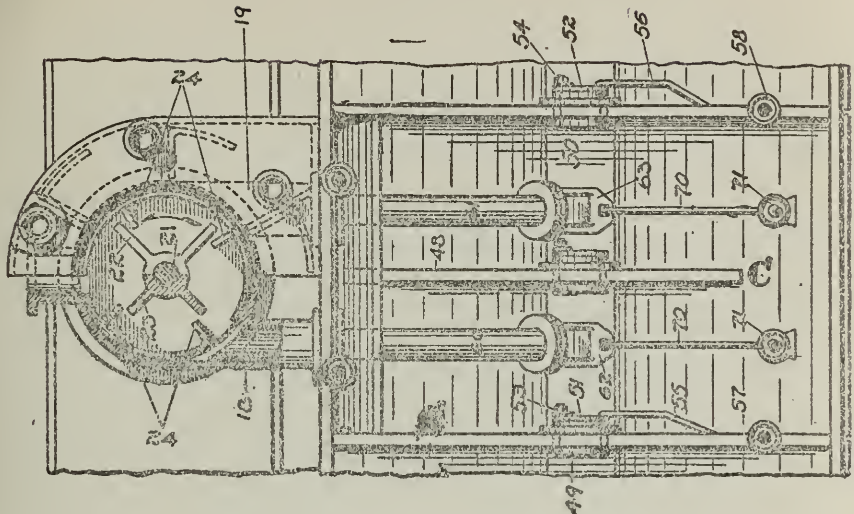
WITNESSES:
B A Mitchell
B. H. Dorenbach

INVENTOR
Thomas A. Janney
BY
Sheridan Wilkinson & Co.
ATTORNEY

T. A. JANNEY.
ORE CONCENTRATING APPARATUS.
APPLICATION FILED AUG. 10, 1914.

,167,076. Patented Jan. 4, 1916.
3 SHEETS—SHEET 2.

Fig. 2



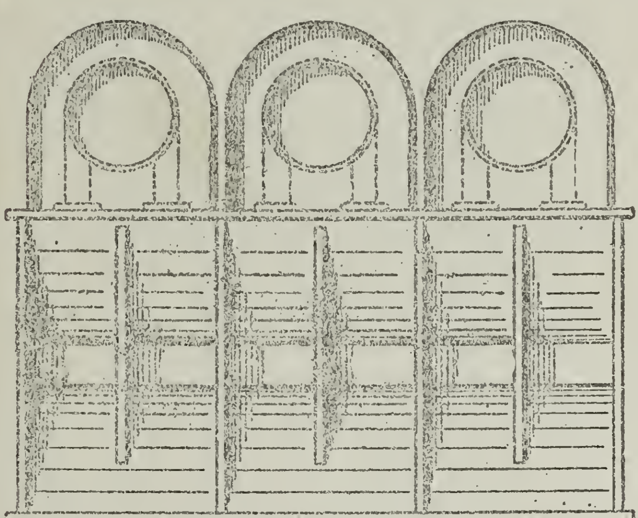


Fig. 4.

WITNESSES:
E. M. Mitchell
B. H. Rosenbach

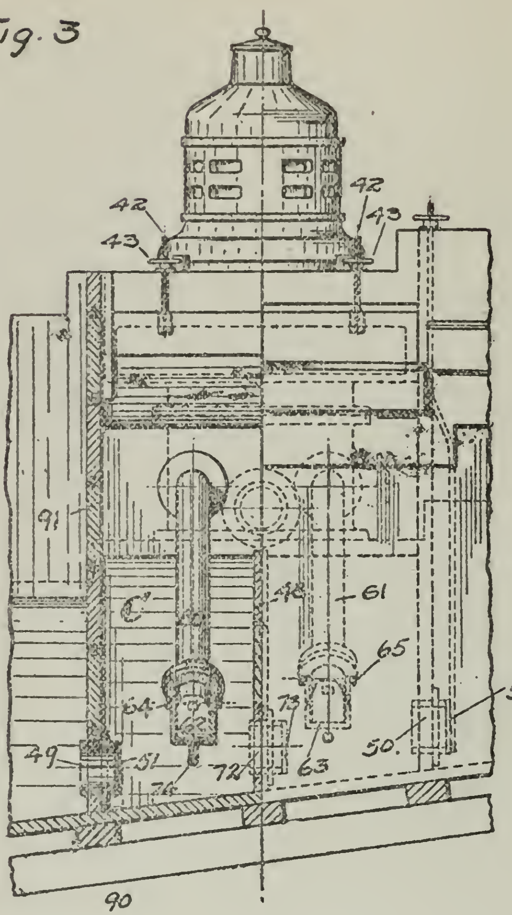
INVENTOR
Thomas A. Janney.
BY
Sheridan Wilkinson & Scott
ATTORNEY

T. A. JANNEY.
ORE CONCENTRATING APPARATUS.
APPLICATION FILED AUG. 10, 1914.

1,167,076.

Patented Jan. 4, 1916.
3 SHEETS—SHEET 3.

Fig. 3



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BY
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UNITED STATES PATENT OFFICE.

THOMAS A. JANNEY, OF GARFIELD, UTAH.

ORE-CONCENTRATING APPARATUS.

1,167,076. Specification of Letters Patent. **Patented Jan. 4, 1916.**

Application filed August 10, 1914. Serial No. 856,092.

To all whom it may concern:

Be it known that I, THOMAS A. JANNEY, a citizen of the United States, residing at Garfield, in the county of Salt Lake and State of Utah, have invented certain new and useful Improvements in Ore-Concentrating Apparatus, of which the following is a specification.

The object of my invention is to provide an improved apparatus for carrying out flotation processes of concentrating ores.

The apparatus herein described and claimed is of the same general type as that set forth in my copending application, Serial No. 833,973, filed April 23, 1914, in that its operation involves repeated circulation of the ore pulp in each unit of the apparatus, but differs in the simplification of the connections between different units of the apparatus when arranged in series, thus economizing space, simplifying construction, and giving a more direct flow of the pulp from one unit of the apparatus to the next.

Another improved feature of the apparatus herein described and claimed is the use of an agitating vessel of less depth than, and arranged on a higher level than the related separating box or spitzkasten of the same unit. The shallower agitating vessel leads to a great economy in power by reason of the fact that the agitating blades are submerged under a much less head of liquid and hence impart the requisite stirring while working against a much decreased pressure, and at the same time the necessary depth of the separating box is maintained, thus giving ample opportunity for separation of the floating and sinking constituents and preventing disturbance of the floating material by the currents caused by removal of pulp from the bottom of the box.

The particular object and nature of my invention, and the scope thereof, will more fully appear from the following description, and the accompanying drawings of one form of apparatus embodying the same.

In the drawings, Figure 1 is a vertical section through the agitation vessel and the connected separating box. Fig. 2 is a plan view partly in section to more fully show the construction. Fig. 3 is an elevation of the apparatus, partly in section, from the right hand side of Fig. 1. Fig. 4 is a diagrammatic plan view of several units of the apparatus connected in series.

The apparatus rests upon a foundation 1 having an elevated pedestal to support the agitating vessel D at a higher level than the separating box C.

The agitating vessel in the particular form of the device illustrated, consists of two main castings, A and B, the former resting upon the foundation *l*. In the lower casting A at the bottom of the agitation vessel, I provide a drainage spout 6 to which is fitted a valve consisting of plate 9 secured to the end of spout B, tubular extension 10, and valve member 7 pivoted at 8 and adapted to control the outlet from the bottom of the agitation vessel. In operation the drainage spout 6 is closed and is opened only for the purpose of flushing out the apparatus when shut down for repairs or otherwise.

The upper casting B of the agitation vessel comprises a lower cylindrical part 11, seated on the lower casting 4, an outwardly extending substantially horizontal part 12, from which there extends upwardly the part 13, which is closed at its upper end by the inwardly extending top flange 14 and by the base 15 of the motor casing 16. The part 13, as shown in Fig. 2, is cylindrical in form on the side away from the spitzkasten, but rectangular on the side adjoining and communicating with the spitzkasten. A cylindrical lining 17 extends from the bottom of the main chamber of the agitation vessel to a point considerably above the outward projection 12 of the upper casting B, the lining being apertured opposite the spout 6, and opposite the ducts 18, 19 which form part of the lower casting and communicate with the separating box C.

The enlarged part 13 of the upper part of the agitation vessel is provided on the side thereof adjacent the separating box with an outlet opening 20 through which the pulp after being agitated and thrown upwardly over the upper edge of the lining 17, may flow to the separating box C.

The shaft 25 of an electric motor within the casing 16 is detachably connected to the agitator shaft 21 by a coupling 26, and two agitators 22 and 23, each consisting of four radial arms, are secured to the shaft 21. Projecting inwardly from the lining 17 of the agitation vessel D, are ribs or baffles 24, the arms of the lower agitator 23 being shorter than those of the upper agitator 22 in order to just clear the baffles and just clear the inner surface of the lining 17. The upper casting B of the agitation vessel D is strengthened by braces 27 and 28 which are cast integral therewith. Liner plates 29, are bolted or otherwise secured to the braces 28 on the side thereof against which the pulp is thrown by the agitator. In the present instance the agitator is designed to revolve in the direction indicated by the arrow in Fig. 2. The braces 28 and liner plates 29, perform the additional function of preventing the pulp, which is thrown upwardly and outwardly by the agitator, from escaping through the air inlet pipes 30, which extend upwardly from openings in the top 14 of the agitation vessel, the upwardly extending pipes themselves forming an additional safeguard against escape of pulp. Upon the upper ends of the pipes 30 are valve casings 31, provided with valves 33 to regulate the admission of air, and with deflector plates 32 extending across the axes of the casings 31 to arrest any pulp that might be thrown upwardly in the pipes 30. The circular movement of the pulp as it is thrown upwardly is arrested by the plates 29, thus causing the pulp to fall into the launder formed outside of the liner 17 by the upper part of the liner, the outwardly extending floor 12 and the vertical wall 13.

The spitz box or separating box C is placed opposite and adjacent the agitation vessel D and is of the usual tapering form at its lower end. The side 40 of the separating box adjoining the agitation vessel is provided with an opening 20′, registering with the opening 20 in the enlarged part 13 of the agitation vessel, and a sliding valve or gate 41 is provided for regulating the opening 20—20′. The gate 41 is suspended on screw-threaded rods 42 in engagement with screw-threaded adjusting wheels 43 which rest upon supports at the upper edge of the wall of the box.

Extending upwardly and outwardly from a point below the opening 20—20′ I provide a guide plate 45 designed to give an upward direction to the pulp issuing from the opening 20—20′.

The box C is provided with an adjustable overflow gate 46. Extending upwardly from the bottom of the separating box C is a partition or baffle 48, the upper edge of the same being located about midway between the bottom of the box and the water level therein as determined by the overflow gate 46.

Pulp enters and leaves the apparatus through inlet and outlet openings 50 and 49, in the sides of the separating box, but is prevented by the baffle 48 from passing through the separating box without traversing the agitation vessel. Extending from the lower part of the separating box are two circulation pipes or ducts 60, 61, one on each side of the baffle 48. These pipes 60, 61 extend upwardly to the side of the box next the agitation vessel, where they communicate through ports in the side of the box, with the ducts 18, 19, extending outwardly from the lower part of the agitation vessel. The openings in the lower ends of the pipes 60, 61, are controlled by valves 62, 63, which have arms pivoted to said pipes as indicated at 64 and 65 and have an arcuate movement across the ends thereof. The valves 62, 63, are provided with operating rods 70, and are adjusted by hand wheels 71 screw-threaded thereon. The inlet and outlet openings 50 and 49, are regulated by valves 51, 52, which are operated by hand wheels 57, 58, screw-threaded on operating rods 55, 56. The baffle 48, is provided with an opening 72 at the lower part of the separating box, which opening is normally closed by a valve 73, when the apparatus is in operation, the valve 73 being opened only when one unit of a series is to be put out of operation without disturbing the operation of the other members or units of the series.

Water supply pipes 74, having their ends directed into the ends of the pipes 60 and 61, are provided for the purpose of flushing the apparatus in case it gets clogged through settlement of the pulp.

In operation the apparatus may be used either in single units or in series as diagrammatically illustrated in Fig. 4. In operation the apparatus is first started or primed with water, ore pulp not being admitted until after the apparatus is started with water. In this way all liability is avoided of clogging the apparatus by settlement of the ore, which might occur if pulp were admitted before a current was established through the apparatus. In starting a single unit of the apparatus, the outlet valve 49 of the separating box is closed and the inlet and circulation valves opened. As soon as the apparatus fills with water to a height sufficient to submerge the lower agitator 23, the agitator commences to agitate and force the water upward in the agitation vessel D, and to throw it through the opening at the top thereof, whence it flows through the duct 20—20′ to the separating box C. A higher effective level or hydraulic head is thus established in the separating box and the water begins to flow back to the agitation vessel D through the ducts 60, 61, thus establishing the local circulation. Thereupon the outlet 49 is opened, and pulp instead of water is admitted through the inlet 50. If several units are to be operated in series as diagrammatically illustrated in Fig. 4, the several units are preferably arranged upon an incline, the pulp entering the highest unit and discharging from the lowest. In Fig. 3 I have shown the bottom of the separating box inclining downward from the inlet to discharge side, and this inclination is inuous in a series of machines, the bot- 90 extending under all of the separating s at the same inclination and the differ- boxes being separated from each other vertical walls 91. The extent of local ulation imparted to the pulp in each of the apparatus may be regulated ugh adjustment of the valves and speed the agitators, the circulation being ght about by the fact that pulp is dis- ged upward from the agitation vessels the spitz box at a more rapid rate than supplied to and discharge from the aratus through the inlet 50 and outlet 49. baffles or partitions 48 prevent the heavy coarse material or any part of the pulp passing directly through the separat- box without entering the agitation ves- and thus insure circulation. I provide opening 72 in the baffle or partition 48, this opening is closed in the operation of apparatus by a valve 73. In case how- it is necessary to stop the operation of one unit of a series for repairs or other pose, this may be done without inter- ing the operation of the other members he series, it being necessary merely to the valve 73 in the partition or baffle, permitting the pulp to flow directly ugh the separating box C of the disabled , without traversing the agitation vessel eof.

operation it may be found advanta- s to adjust the gate 41 controlling the 20—20′ leading to the separating box the agitation vessel with the lower of the gate beneath the liquid level. his event air cannot flow into the agita- vessel through the port 20—20′, and I therefore provided the air pipes 80 inbefore described, and the air valves whereby the amount of air admitted to agitation vessel may be controlled for the pose of governing the character of froth luced.

hat I claim is:

In a device of the class described, an ation vessel, a separating box having ad- sion and discharge chambers provided admission and discharge ports respec- ly, admission chamber and discharge mber circulation ports connecting said mbers respectively with the lower part aid agitation vessel, and means for mov- an ore pulp upwardly in said vessel and said box.

In a device of the class described, an ation vessel, a separating box having ad- sion and discharge chambers provided admission and discharge ports respec- ly, admission chamber and discharge mber circulation ports connecting said mbers respectively with the lower part of agitation vessel, said separating box having an overflow lip, a duct connecting said vessel and box at a point above said overflow lip, and means for impelling an ore pulp upwardly in said vessel.

3. In a device of the class described, an agitation vessel, a separating box having admission and discharge chambers provided with valved admission and discharge ports respectively, admission chamber and discharge chamber circulation ports connecting said chambers respectively with the lower part of said agitation vessel, valves in said ports, said separating box having an overflow lip, a duct connecting said vessel and box at a point above said overflow lip, and means for impelling an ore pulp upwardly in said vessel.

4. In a device of the class described, an agitation vessel, a separating box adjacent said vessel and communicating therewith through two ducts adjacent the bottom thereof, a baffle extending upward from the bottom of said box between said ducts to a point above the same, admission and discharge ports communicating with said box on opposite sides of said baffle, and means for moving an ore pulp upwardly in said vessel and into said box.

5. In an apparatus of the class described, a series of separating boxes and agitation vessels, each of said separating boxes having communication adjacent its lower end with an adjoining agitation vessel, and each box having communication adjacent its lower end with the next succeeding box, a duct extending from each agitation vessel above the liquid level in the adjoining separating box and opening into said box, means for forcing an ore pulp upwardly in said agitation vessels, and means for compelling pulp entering each box to pass through the adjoining vessel before passing to the next box.

6. In a device of the class described, an agitation vessel, a separating box extending to a lower level than said vessel, an upper duct connecting said vessel and box at a point higher than the liquid level therein, and a lower duct connecting the same beneath the liquid level, and means in said vessel for agitating an ore pulp and impelling the same upward through said duct.

7. In a device of the class described, a separating box provided with an overflow, an agitating vessel of less depth than said box and opposite the upper part thereof, said vessel having an opening above said overflow and leading to said box, said vessel and box being also connected by a duct leading from the lower part of said box, and means in said vessel for agitating an ore pulp and impelling same upwardly.

8. In a device of the class described, a series of units each comprising an agitation vessel and separating box, ducts connecting said boxes at a point adjacent the bottoms

thereof and ducts leading from the lower part of said boxes to said vessels and partitions extending upwardly from the bottom of said boxes to prevent direct flow of pulp therethrough.

9. In a device of the class described, a series of units each comprising an agitation vessel and separating box, ducts connecting said boxes at a point adjacent the bottoms thereof and ducts leading from the lower part of said boxes to said vessels and partitions extending upwardly from the bottom of said boxes to prevent direct flow of pulp therethrough, said partitions having orifices and valves controlling said orifices.

10. In a device of the class described, an agitation vessel and separating box communicating with each other by a duct extending above the liquid level in said box and opening into said box substantially at the liquid level, a substantially air-tight cover over said box, said cover having air inlet openings and means for controlling the inflow of air through said openings.

In testimony whereof, I have subscribed my name.

THOMAS A. JANNEY.

Witnesses:
R. H. Hawley,
Walter A. Scott.

Filed May 18, 1917. GEO. W. SPROULE. Clerk.
By H. H. WALKER, Deputy.

T. A. JANNEY

Pltfs.' Exhibit No. 3

ORE CONCENTRATING APPARATUS.

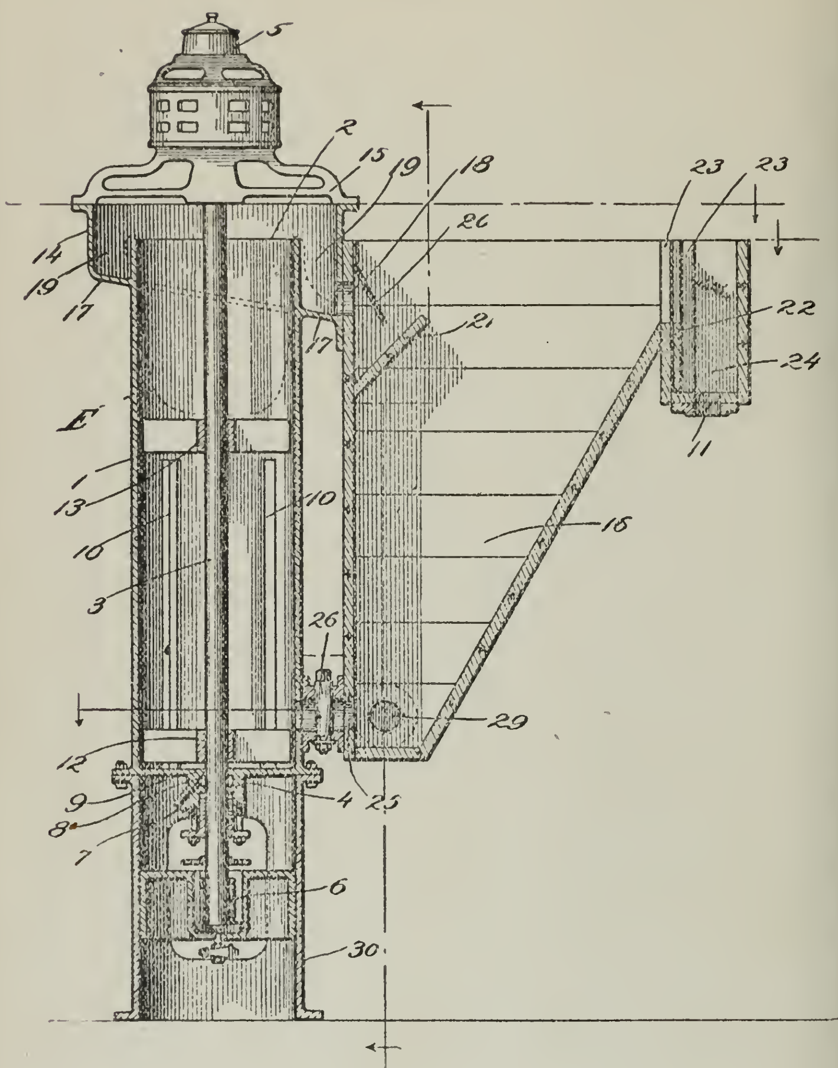
APPLICATION FILED APR. 23, 1914.

1,201,053.

Patented Oct. 10, 1916.

3 SHEETS—SHEET 1.

Fig. 1.



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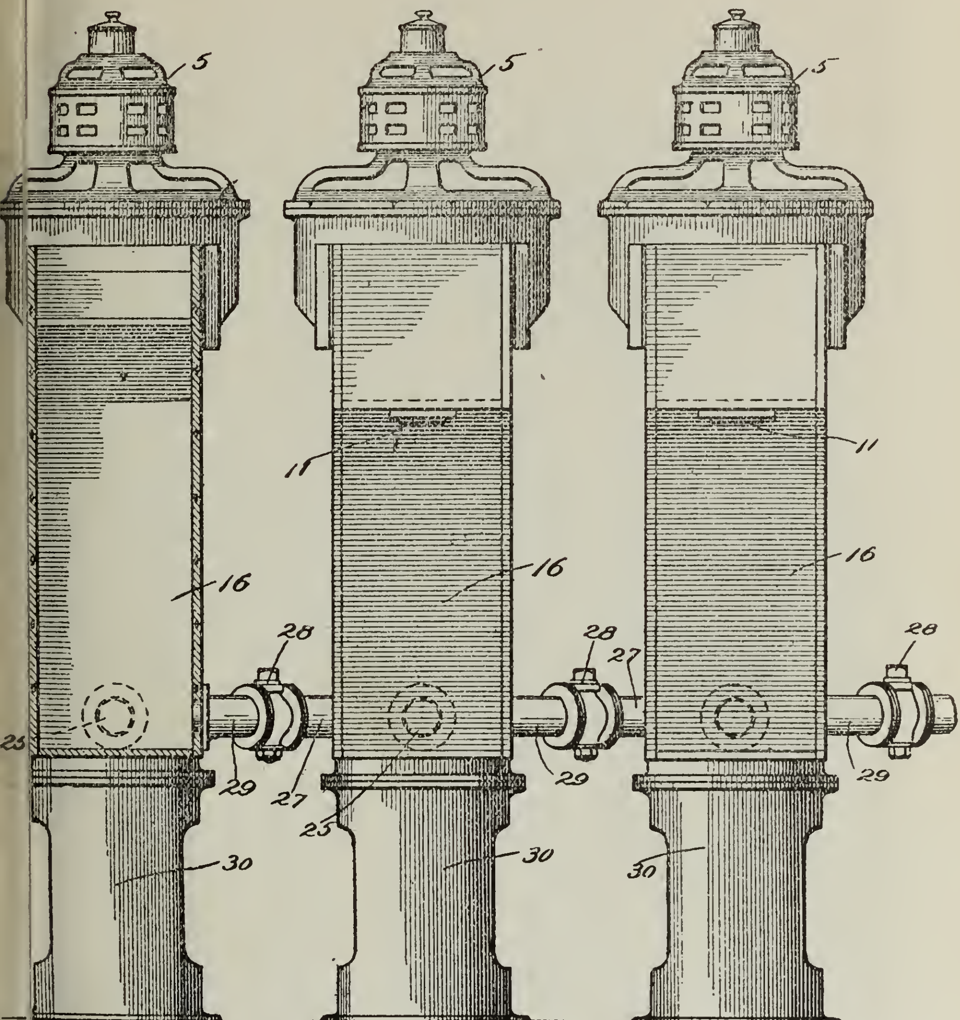
T. A. JANNEY.
ORE CONCENTRATING APPARATUS.
APPLICATION FILED APR. 23, 1914.

1,201,053.

Patented Oct. 10, 1916.
3 SHEETS—SHEET 2.

Fig. 2.



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T. A. JANNEY.

ORE CONCENTRATING APPARATUS.

APPLICATION FILED APR. 23, 1914.

1,201,053. Patented Oct. 10, 1916.

3 SHEETS—SHEET 3.

Fig. 3.

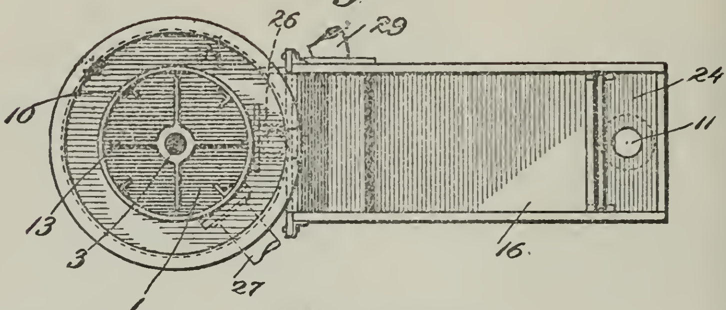
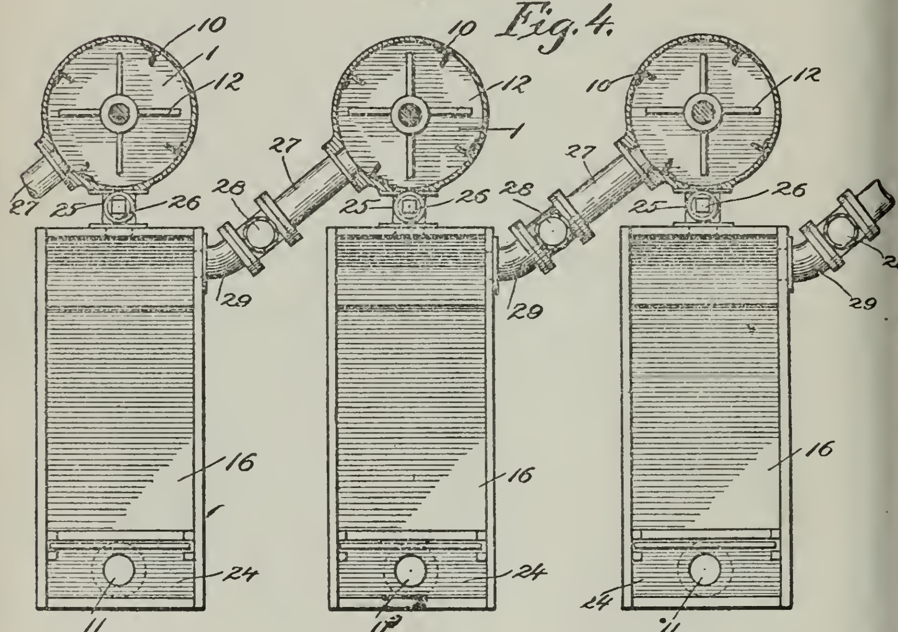


Fig. 4.



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UNITED STATES PATENT OFFICE.

THOMAS A. JANNEY, OF GARFIELD, UTAH.

ORE-CONCENTRATING APPARATUS.

201,053. Specification of Letters Patent. Patented Oct. 10, 1916.

Application filed April 23, 1914. Serial No. 833,973.

all whom it may concern:

3e it known that I, THOMAS A. JANNEY, a itizen of the United States, residing at G rfield, in the county of Salt Lake and S ate of Utah, have invented certain new a l useful Improvements in Ore-Concen- t ting Apparatus of which the following is a specification.

My invention has for its object the im- p vement of apparatus used in the concen- t tion of ores by the oil flotation process, i which process the ore mixed with water i the form of a freely flowing pulp is agi- t ed with oil and other reagents, if such a necessary or beneficial, with the result t t the metalliferous part of the ore is c sed to float when the pulp is removed f m the zone of agitation and permitted to a ime a condition of substantial quiescence. T is process can be carried out in many d erent forms of apparatus, but the appa- r us forming the subject-matter of my in- v tion possesses several distinct and novel a antages, among which are the facts that t apparatus, embodying a series of agitat- i chambers or mixers and separation b es, or spitz-boxes, may all be arranged u n the same level, the energy used for a tating the pulp serving in conjunction w h gravity the purpose of moving the p p through the series of agitation cham- b s and spitz-boxes. In my improved ap- p atus the mixture may also be subjected t uccessive periods of agitation and flota- ti in each unit of the series, this being e cted by moving the mixture through as m y cycles as desired in each unit before t asses to the next unit of the series. An- o er advantage arises from the fact that w n a single agitating chamber and sepa- r ng box are used for treating a single c rge, the pulp may be permitted to cir- c te for an indefinite period of time t ugh said chamber and box without per- s al attention, the floating concentrate be- i allowed to accumulate in the separating b from which it may be removed inter- m tently by mechanical means or overflow, o being removed by overflow continuously f ormed, such overflow being effected by s itably regulated supply of water or pulp o er advantages in simplicity of structure t he apparatus, durability and simplicity of operation will appear from the following description and drawings, in which—

Figure 1 is a vertical sectional view through an agitating chamber and separating box. Fig. 2 is an elevation partly in section of several units connected in series, each unit consisting of an agitating chamber and separating box, the section being through the separating box of the first unit. Fig. 3 is a plan view of the structure shown in Fig. 1; and Fig. 4 is a fragmentary plan view of the structure shown in Fig. 2, the agitating vessels being in section upon a plane between the lower and upper agitators.

I will describe the mechanical construction of the apparatus principally with reference to Figs. 1 and 3 for the reason that those figures being in section best illustrate the interior construction. While in my description I refer to the specific form and arrangement of various parts, it will be apparent that wide variations may be made in the mechanical form of the apparatus without departing from the invention as defined in the appended claims.

The agitating chamber 1 is preferably cylindrical in form with an open upper end forming a discharge outlet 2. A rotary shaft 3 extends axially into the interior of the agitating chamber 1. In the form of the device illustrated the shaft 3 is rotated by an electric motor 5 supported upon the top of the apparatus and the lower end of the shaft 3 extends through the bottom of the vessel 1 and is provided with a bearing 6 beneath and exterior to the vessel 1, which is supported upon a suitable standard 30. Leakage from the vessel 1 is prevented by a stuffing-box 4 of any suitable form. For the purpose of protecting the packing in the stuffing-box 4 and the bearing 6 from the injurious action of any of the pulp which might leak past the stuffing-box, I provide a small opening, or duct, 7 leading through the wall of the stuffing-box above the packing therein and opening into an annular chamber 8, which communicates through passage 9 with the lower part of the vessel 1. A constant supply of clear water under sufficient pressure passes through the duct 7 into the vessel 1, thus preventing leakage of any pulp with its contained ore. The water so supplied through the passage 7 may, under some conditions of operation, serve the additional purpose of maintaining the pulp in the apparatus at the proper level, that is, the water so supplied may be utilized to compensate for the lowering of level that would otherwise be caused by withdrawing the floating concentrate. The bearing 6 beneath the vessel 1 serves to hold the shaft 3 in proper alinement and to prevent vibration or whipping.

Projecting inwardly from the wall of the cylindrical vessel 1 are a plurality of baffles 10 which take the form of inwardly projecting ribs. These baffles extend upwardly about midway the height of the vessel 1. Upon the shaft 3, adjacent the bottom of the vessel 1, there is secured an agitator or impeller 12, which preferably takes the form of a series of radiating arms, four in number, as shown in the construction illustrated. The radial arms of the agitator 12 extend outwardly with just sufficient clearance for safety between the ends thereof and the baffles 10. A second agitator or impeller 13 is secured to the shaft 3 just above the upper ends of the baffles 10, the radial arms of the upper impeller preferably being longer than those of the lower impeller and having just sufficient clearance between their ends and the wall of the vessel 1 to afford safety of operation.

Rotation of the agitators 12 and 13, in conjunction with the baffles 10, serves to impart a violent agitation to the pulp treated in the apparatus. The lower agitator in conjunction with the baffles imparts a violent agitation to the pulp, thus thoroughly intermingling the ingredients thereof, and also serves through centrifugal force to impart a tendency to the pulp to rise upon the walls of the vessel. The upper agitator 13 lying near the surface of the pulp imparts further rotary movement to the same and centrifugal force causes the pulp to rise upon the walls of the vessel and overflow the upper edge of the same as diagrammatically indicated by the dotted line E in Fig. 1. Of course the precise configuration of the upper surface of the pulp will vary according to conditions such as the speed of agitation and rate of supply of pulp to the apparatus. In order to avoid the possibility of any of the pulp being ejected from the apparatus, I preferably inclose the upper end of the agitating chamber 1 with a hood 14 which surrounds the upper end of the agitating chamber and extends a short distance above the same. The upper end of the hood 14 may be closed by a cover 15. Adjoining the agitating chamber 1 is a separating box 16, the same preferably taking the form of a spitzbox, or box tapering to substantially a point at its lower end.

The hood 14 is closed by a lower wall 17 situated beneath the upper edge or discharge opening 2 of the chamber 1, said wall 17 closing the bottom of the annular space between the agitating chamber and hood and forming a launder to receive the pulp. Just above the wall 17 is a discharge duct 18 leading from the annular space 19 to the upper part of the separating box 16. In order to keep the material in the separating box 16 substantially quiet, I provide a deflector or baffle 20 extending downwardly from the wall of the hood 14 across the opening 18 and spaced sufficiently from the opening 18 to permit free flow of the pulp. I may also provide a second deflector or baffle 21 projecting upwardly across the opening 18 beyond the deflector 20. These deflectors serve to arrest the current of pulp flowing into the separating box and to convey the pulp into the separating box without causing any material disturbance of the pulp therein, thus producing a condition conducive to the formation of the floating concentrate.

At one or more edges the separating box 16 is provided with an overflow lip at substantially the same level as the bottom of the port 18. Said lip is formed by the upper edge of a wall 22, which may be adjustable through a small range, taking the form of a vertically movable gate operated by any suitable means between guides 23. The rate of flow of pulp through the apparatus may be so regulated that the floating material flows over the upper edge of the gate 22 into the launder 24 from which the same may be collected through the discharge opening 11 as a finished concentrate, or for further treatment as the case may be. By reason of the duct 18 and discharge lip of the gate 22 being upon substantially the same level the agitated pulp from the agitating vessel is deposited upon the surface of the pulp in the separator box. I find this to be a distinc advantage over apparatus in which the agitated pulp is discharged into the separato box a considerable distance beneath the surface of the pulp in the separator box.

The lower part of the separating box 1 is connected with the lower part of the agitation vessel 1 by means of a passage 25. Th passage 25 opens into the vessel 1 opposit or above the lower agitator 12, the effect c this location of the opening of the passag 25 into the vessel 1 being that the pulp er ters the vessel 1 from the separating box 1 against the outward centrifugal force in parted to the material in the vessel 1 by tl agitator 12. That is. the flow of pulp fro the separating box 16 into the vessel 1 is r tarded, but not prevented, by the agitat 12. For the purpose of regulating the flo of pulp from the lower part of the separa ing box into the vessel 1 the passage 25 provided with a regulating valve 26, whi may be of any suitable form, such as a pl valve. Pulp is supplied to the apparatus through the pipes or ports 27. These ports 27 are provided with suitable regulating valves 28. After treatment in the apparatus, or one unit thereof, the pulp is withdrawn through the ports 29, which lead from the lower parts of the spitz-boxes.

When the apparatus is used in series, as illustrated in Figs. 2 and 4, the outlet ports 29 from the separating or spitz-boxes 16, communicate with the inlet ports 27, which communicate with the next adjacent agitating vessel. When the apparatus is used as a single unit, either for experimental or practical operations, the inlet port 27 of the agitating vessel 1 is closed after the apparatus is charged with the proper amount of pulp and other ingredients, and the outlet port 29 leading from the spitz-box 16 is also closed until it is desired to discharge the residues or tailings. When operated as a single unit the port 29 is first closed and a suitable amount of pulp with the other necessary ingredients is charged into the apparatus through the port 27, or, if convenient, simply through the open top of the separating box, or in any other convenient manner.

In operating upon a single charge, as above stated, it will be understood that both of the ports 27 and 29 are closed and the port 25 is opened to a suitable extent through manipulation of the valve 26. The charge of pulp supplied to the apparatus is insufficient to fill the same and preferably the level of the pulp before agitation is started is considerably below the upper edge of the chamber 1. The rotation of the agitators 12 and 13 imparts a violent agitation to the mixture of ore, pulp and oil, thus disseminating the oil and causing efficient contact thereof with the metalliferous mineral particles and at the same time impels the pulp mixture upward through the agitating chamber 1 and discharges the same over the top edge, 2, thereof, as hereinbefore explained. The pulp so forced upwardly out of the agitating chamber falls in the annular space 19 between the upper end of the agitating chamber and the surrounding hood and by gravity flows through the duct 18 into the separating box 16, the pulp at the same time flowing from the bottom of the separating box 16 into the lower part of the agitating chamber 1 by reason of the higher head of water established in the separating box 16 due to the discharge of pulp therein through the duct 18. A continuous current of pulp mixture upward through the agitating chamber 1 and downward through the separating box 16 is thereby caused.

The operation as described is to cause the oiled metalliferous part of the ore to float upon the surface of the pulp in the separating box, the surface of which is substantially quiet. If desired the level of the pulp in the separating box 16 may be so maintained that the floating concentrate as formed will float over the upper edge of the gate 22 into the launder 24. Such regulation of the level of the pulp may be effected in various ways, as by the inflow of water through the passage 7 at the lower end of the agitating vessel. If desired the surface of the pulp in the separating box 16 may be maintained at a point below the upper edge of the gate 24 and the froth as formed may be removed by mechanical means such as skimming.

In the operation of the apparatus as a single unit, as above described, the pulp is thoroughly agitated, together with the materials added thereto, and is impelled upward through the agitating vessel 1, whence it flows through the port 18 into the separating box 16, downward through the separating box and back to the agitating vessel 1 through the port 25. The pulp thus moves through a continuous cycle comprising alternate periods of agitation and quiescence. During the period of quiescence the concentrate which has been sufficiently treated floats upon the surface of the pulp in the separating box 16, while the remainder of the pulp continues to circulate through the agitating vessel and spitz-box. As the pulp so circulates floating concentrate gradually separates therefrom upon the surface of the pulp in the separating box until the material treated is practically exhausted of its valuable content. I have found that in the operation of the apparatus the continuous circulation of the pulp through the separating box and agitating vessel takes place without material interference with the flotation of the concentrate and that the amount of floating concentrate upon the surface of the pulp in the spitz-box gradually increases. A considerable amount of concentrate may be allowed to so accumulate upon the surface of the pulp in the spitz-box before it is necessary to withdraw the same. In operation, however, I find it preferable to remove the float from the surface of the pulp in the spitz-box at intervals or continuously and before too great a volume of float has been built up. As above indicated the removal of the float may be either intermittent and effected by overflow or mechanical means, or the removal of the float may be effected by maintaining a suitable supply of water through the port 7, clear water being supplied when it is desired to treat a definite amount of ore.

A single unit of the apparatus, such as illustrated in Fig. 1, or several units connected in series, as shown in Fig. 2, may be used for the treatment of a continuous flow of pulp through the apparatus. I will first refer to the use of a single unit of the apparatus in operating continuously upon pulp flowing therethrough. When a single unit of the apparatus is used for continuous treatment of ore pulp, as distinguished from a treatment of a single charge, the pulp is supplied to the mixing vessel 1 through the port 27, which need not be located precisely as shown in the drawings, but is preferably located somewhere adjacent the bottom of the mixing vessel. The port 25 is left open, adjustment of the duct through the port, if necessary, being made by means of the valve 26. The pulp carrying with it oil and such other ingredients as necessary for the flotation of pulp flowing in through the port 27 is subjected to violent agitation and to an upward force due to the rotation of the agitator 12 and further agitation and upward impulse is given to the pulp by the rotation of the upper agitator 13. The upward impulse so imparted to the pulp carries the same over the upper edge of the agitation vessel 1 and into the launder 19 and through the port 18 to the separating box 16 as above described. The surface of the pulp in the separating box 16 being substantially quiet the concentrate floats thereon as soon as the material has received sufficient treatment to produce that effect. As the rate of discharge through the port 29 is substantially constant, and as the agitator-impeller moves the pulp from the agitation vessel to the separator box at a more rapid rate, the excess pulp so moved to the separator box will return to the agitation vessel through the port 25, and will continue to move through the local circuit or cycle comprising the agitation vessel, separator box and connecting ports until finally discharged through port 29. By suitable adjustment of the valves and speed of the agitator-impeller the amount of pulp which is moved through this local circuit and the number of cycles of movement imparted to it may be regulated. For instance, if the port 29 be considerably restricted and the port 25 be opened to a relatively large extent, a portion of the pulp will circulate through the circuit formed by the agitation vessel, the port 18, the settling box 16, and the passage 25, a considerable number of times before being discharged through the port 29, the amount of such circulation imparted to the pulp depending, as above stated, upon the degree to which the ports 29 and 25 are opened and will also be influenced by the speed of the agitator. During the operation of the apparatus as described the concentrate will gather as a float upon the surface of the pulp in the settling box 16 and may be removed continuously by regulating the feed through the port 27 in such manner that the floating material will pass over the upper edge of the gate 22 into the concentrate launder 24. Or the float may be removed intermittently or continuously by mechanical means, such as a skimmer, or by successive intermittent adjustments of the pulp level.

In the use of mechanism, such as heretofore employed in the flotation process, the pulp passes through each agitating vessel but once and successive treatments of the pulp are obtained only by increasing the number of agitating vessels. In my improved apparatus if the working capacity of the apparatus is 500 gallons and 100 gallons per minute are constantly fed through the inlet port 27 and a corresponding amount per minute constantly discharged through the waste port 29, in conjunction with that taken off as concentrate in the concentrate launder 24, there will constantly be in circulation in the apparatus 500 gallons of pulp. Owing to the fact that the agitators impel the pulp at a rate much greater than 100 gallons per minute, a portion of the pulp will circulate through the agitating vessel 1 and separating box 16 many times before it is discharged through the port 29. In other words, the agitators impel the liquid from the agitating vessel into the spitz-box at a more rapid rate than the pulp can be discharged through the waste port 29, and the result is that the material not discharged through the waste port 29 again enters the agitation vessel 1, through the port 25 to again pass through the same circuit until finally withdrawn through the port 29 as waste or in the launder 24 as concentrate. While the flow of pulp from the separating box 16 through the port 25 into the agitation vessel 1 is somewhat resisted by the outward centrifugal force set up by the lower agitator 12, the head of pulp in the separating box 16 when the pulp has risen sufficiently therein will overcome such resistance and cause the flow of pulp back into the agitation vessel in the course of its circulation through the circuit above described.

When a plurality of units, such as illustrated in Fig. 1, are used in series the several units are connected as shown in Fig. 2, the outlet port 29 of the separating box of the first unit of the series being connected to the inlet port 27 of the agitation vessel of the next unit of the series, the valve 3 serving to control the flow of pulp from one unit to the next. When so used in series the pulp is treated in each unit of the apparatus as heretofore described in connection with the single unit shown in Fig. 1, the pulp not only passing through the entire series of units, but being subjected to local circulation in each unit as above described in connection with the apparatus shown in Fig. 1. The extent of local circulation to which the pulp is subjected in each unit of the series is determined as above described. In nproved apparatus when so used in series ie pulp instead of being conveyed directly irough the several units of the series, as in pparatus heretofore used, is caused to cirulate many times through each unit before assing to the next unit of the series, and luring such repeated local circulation is ubjected to repeated periods of agitation nd quiescence for the formation of floating oncentrate.

It will be apparent that agitating mechaiism different from that herein illustrated ind described may be used for agitating the)ulp and causing the circulation described ibove, and that many of the details of construction may be altered without departing from the principle of my invention.

I claim:

1. In a concentrating apparatus, an agitation vessel and separating box communicating with each other through upper and lower ports, and agitating and impelling means in said vessel for agitating an ore pulp therein and adapted to move all of said pulp from said vessel into said box and to move the pulp in a circuit through one of said ports to said box and back through the other port to said vessel, said box having an overflow lip below the level of said upper port.

2. In a device of the class described, an agitation vessel and separating box having communication with each other through ports at the upper and lower parts thereof, and means for imparting agitation to an ore pulp contained in said vessel and for moving all of said pulp from said vessel through said upper port into said box and for causing pulp to circulate repeatedly through said vessel and box, said box having an overflow lip below the level of said upper port.

3. In a device of the class described, an agitation vessel, means therein for agitating and impelling upwardly an ore pulp, a separating box, an upper duct connecting said vessel and box, said agitating and impelling means being adapted to move all of said pulp from said vessel to said box through said upper duct, and a second duct for conducting pulp back to said vessel from said box, said box having an overflow lip below the level of said upper port.

4. In a concentrating apparatus, a mixing vessel and a separator box having communication ports at points adjacent the top and bottom thereof, and a rotary agitator in said vessel adapted by centrifugal force to elevate all of the ore pulp contained therein and thereby to cause said pulp to flow into said separator box through the upper port, said box having an overflow lip below the level of said upper port.

5. In a concentrating apparatus, an agitation vessel and separator box communicating with each other through two ports, means for feeding pulp to said apparatus and for discharging the same therefrom, and means for agitating said pulp and for moving all of said pulp from said agitation vessel to said separator box at a more rapid rate than the pulp is fed to and discharged from said apparatus, thereby setting up a local circulation of pulp through said vessel, box and connecting ports.

6. In a concentrating apparatus, a mixing vessel and a separator box having communication ports therebetween at points adjacent the top and bottom thereof, said vessel having an ore pulp feed port and said box a tailings discharge port, and a rotary agitator in said vessel adapted to elevate all of the ore pulp supplied thereto and to discharge the same into said box at a more rapid rate than said pulp can be discharged through said discharge port, thereby causing part of said pulp to circulate repeatedly through said vessel and box, said box having an overflow lip below the level of said upper port.

7. In a flotation concentrating apparatus, an agitation vessel having an inlet port for ore pulp, a rotary agitator in said vessel, and a separator box having a discharge lip over which floating concentrate may flow, said vessel and box being connected by a duct above said discharge lip at the upper part of said vessel and opening into said box at substantially the same level as said discharge lip, said agitator being adapted to raise all of the ore pulp supplied to said vessel and to discharge the same through said duct upon the surface of the ore pulp in said box.

8. In a device of the class described, a series of units each comprising an agitation vessel and separating box, the vessel and box of each unit having communication with each other through ports at the upper and lower parts thereof and the box of each unit having communication with the vessel of the next succeeding unit, the first agitation vessel of the series having an inlet port for ore pulp, and means for imparting agitation to the ore pulp in said vessels and for moving all of the ore pulp supplied to each vessel to the communicating box and causing a circulation of pulp through the vessel and box of each unit of the series.

9. In a device of the class described, an agitating vessel having an open upper end, a rotary agitator therein, a launder surrounding the upper end of said vessel to receive ore pulp discharged therefrom, a separator box communicating with said launder, and having an overflow lip below the upper end of said vessel, a duct connecting said box and vessel at a point below said launder, said agitator being adapted to elevate all of the pulp supplied to said vessel and to discharge the same into said box.

10. In a device of the class described, an agitation vessel, having an opening adjacent

its upper end, a separating box having an overflow lip below the level of said opening, a rotary agitator adjacent the bottom of said vessel, and a second rotary agitator above said first named agitator, said second agitator being adapted to operate adjacent the surface of an ore pulp contained in said vessel, said rotary agitators being adapted to elevate all of the ore pulp supplied to said vessel and to discharge the same into said box.

11. In a concentrating apparatus, an agitation vessel and separating box having communication with each other at the upper and lower parts thereof, a rotary agitator adjacent the bottom of said vessel, and a second rotary agitator above said first named agitator, said agitators being adapted to elevate all of the ore pulp supplied to said vessel and to discharge the same into said box thereby causing the pulp to move in a circuit through said vessel and box and to be subjected to alternate periods of agitation in said vessel and substantial quiescence in said box, said separating box having an overflow lip below the level of the upper communication between said vessel and box.

12. In a device of the class described, an agitation vessel having an upper discharge opening, a separating box having an overflow lip below said discharge opening, means for admitting ore pulp to said vessel, means for impelling all of said ore pulp upwardly through said discharge opening to said box, said box being connected with said vessel by a duct leading from the lower part of said box to said vessel.

13. In a device for treating ore pulp, an agitation vessel and separating box, means for admitting ore pulp to said vessel, a wall between said vessel and box, means for maintaining the level of the pulp in said box below the upper edge of said wall, means for impelling all of the pulp supplied to said vessel upwardly and over said wall into said box, and a duct leading from the lower part of said box to said vessel.

In testimony whereof, I have subscribed my name.

THOMAS A. JANNEY.

Witnesses:
WALTER A. SCOTT,
CHARLES E. BURNAP.

Filed May 18, 1917. GEO. W. SPROULE. Clerk
By H. H. WALKER. Deputy

Defendant's Exhibit No. 35.

MAGNA PLANT

Flotation Retreatment Plant Results—Treating Mineral Classifier Overflow and 4th and 5th Spigots
September 1, 1914, to December 24, 1916—Inclusive

Month	Tonnage	HEADING % Cu.	HEADING % Fe.	HEADING % Si02	TAILING % Cu.	TAILING % Fe.	CONCENTRATE % Cu.	CONCENTRATE % Fe.	CONCENTRATE % Si02	Indicated Extraction	Ratio of Concentration	Per Cent Solids	Lbs. Oil Per Day	Lbs. Oil Per Ton
1914														
September	9258	11.55	6.43	69.24	.57	.97	34.32	16.86	18.27	96.67	2.97	41.67	941	3.05
October	10085	10.38	6.31	70.94	.40	1.21	36.52	19.11	11.20	97.21	3.61	45.46	852	2.62
November	13104	9.74	7.00	71.26	.42	1.21	34.45	20.57	12.19	96.87	3.55	50.00	922	2.11
December	11776	10.11	6.26	71.56	.96	1.23	35.39	19.60	13.93	93.03	3.76	40.76	847	2.23
1915														
January	10171	9.43	6.80	70.52	.33	.73	32.87	22.89	12.64	97.51	3.62	42.78	1303	3.97
February	12686	8.13	5.97	74.18	.37		32.12	22.70	14.93	96.38	4.14	44.20	761	1.83
March	16430	8.16	6.08	74.52	.93		29.70	21.58	19.08	91.66	4.09	42.89	641	1.23
April	18350	9.19	6.75	71.42	.48		29.29	20.98	18.36	96.41	3.33	42.13	1133	1.85
May	20229	9.79	6.90	70.60	.29	.69	31.93	21.14	14.81	97.97	3.33	40.42	1434	2.20
June	19036	9.50	6.85	70.58	.42	.75	30.14	20.44	17.12	96.84	3.30	32.10	2607	3.84
July	17613	8.71	6.44	72.69	.43	.64	29.92	20.28	17.24	96.51	3.58	36.58	2629	4.63
August	17778	9.05	6.70	71.76	.29	.60	29.78	20.58	17.00	97.73	3.38	34.72	2185	3.81
September	19014	8.28	6.48	73.09	.40	.58	29.62	22.18	15.06	96.68	3.71	39.40	2445	3.86
October	20792	8.76	6.78	72.48	.35	.64	30.08	21.66	15.30	97.27	3.56	40.86	2530	3.77
November	21211	9.36	7.62	69.36	.32	.58	29.00	22.54	14.70	97.64	3.18	42.08	3058	4.32
December	21216	9.22	7.12	70.56	.22	.54	29.73	21.84	15.22	98.34	3.31	40.56	3225	4.71
1916														
January	18527	8.28	6.36	73.68	.18	.51	31.12	21.61	15.28	98.44	3.86	37.18	3055	5.11
February	19000	7.95	5.42	76.03	.24	.50	32.61	19.80	14.95	97.60	4.28	34.96	3257	4.97
March	20003	7.64	6.51	73.88	.20	.50	28.14	21.16	16.16	98.07	3.76	29.20	3354	5.20
April	21425	7.90	6.51	73.37	.36	.48	27.60	21.06	18.30	96.68	3.62	28.82	3758	5.37
May	24142	7.25	6.06	75.23	.28	.50	27.55	20.74	19.42	97.09	3.91	31.12	3650	4.69
June	28510	7.62	5.78	75.56	.34	.52	30.10	20.84	16.14	96.62	4.12	30.66	3731	3.93
July	29910	7.62	6.00	75.10	.26	.51	29.48	21.53	15.74	97.42	3.96	29.20	3759	3.90
August	30333	7.68	6.08	75.19	.26	.54	29.87	21.19	16.01	97.52	3.98	32.08	3784	3.87
September	30266	7.80	5.90	75.02	.25	.47	29.88	20.62	17.20	97.57	3.93	33.34	3985	3.95
October	32494	7.67	6.07	74.92	.18	.58	30.75	21.18	14.86	98.31	4.08	33.20	3932	3.75
November	30375	7.35	5.70	76.08	.17	.60	29.78	20.40	17.00	98.24	4.13	33.82	3804	3.76
December (24 days)	24429	6.92	5.65	76.70	.12	.54	29.09	20.94	17.37	98.69	4.26	33.45	3903	3.83
AVERAGE		8.350	6.317	73.510	.290	.614	30.294	21.013	16.116	97.461	3.723	36.001	3790	3.790
TOTAL	568163													
AVG. PER DAY	671.6													

Magna, Utah,
April 7, 1917.

R. A. CONRADS,
Metallurgical Engineer.

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Defendant's

UTAH COPPER COM

METALLURGIC

Composite Flotation Retreatment Plant Results for

DATE	HEADING				TAILING			CONCENTRATE				Per Cent Indicated Extraction	Ratio of Con centr'n
	Dry Tons	% Cu.	% Fe.	% SiO2	Dry Tons	% Cu.	% Fe.	Dry Tons	% Cu.	% Fe.	% SiO2		
December	4011	5.616	3.529	83.580	3284	.126	.327	727	33.218	16.433	20.713	98.223	6.170
January	28722	6.515	4.958	78.766	22343	.106	.372	6379	29.414	19.664	19.361	98.727	4.573
February	26206	6.925	6.028	75.808	20091	.121		6115	29.337	22.637	14.143	98.660	4.294
March	31266	6.561	5.871	76.678	23356			22361	27.369	21.691	17.143	97.887	4.261
April	7589	6.351	6.092	76.910	5905	.181		7856	24.731	21.618	20.625	95.230	4.089
Total	97794				75733	.401		1438					
Average	940	6.590	5.566	77.359	725	.157	.366	216	28.458	21.196	17.359	98.161	4.399

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Exhibit No. 36.

PANY—MAGNA PLANT

AL DEPARTMENT

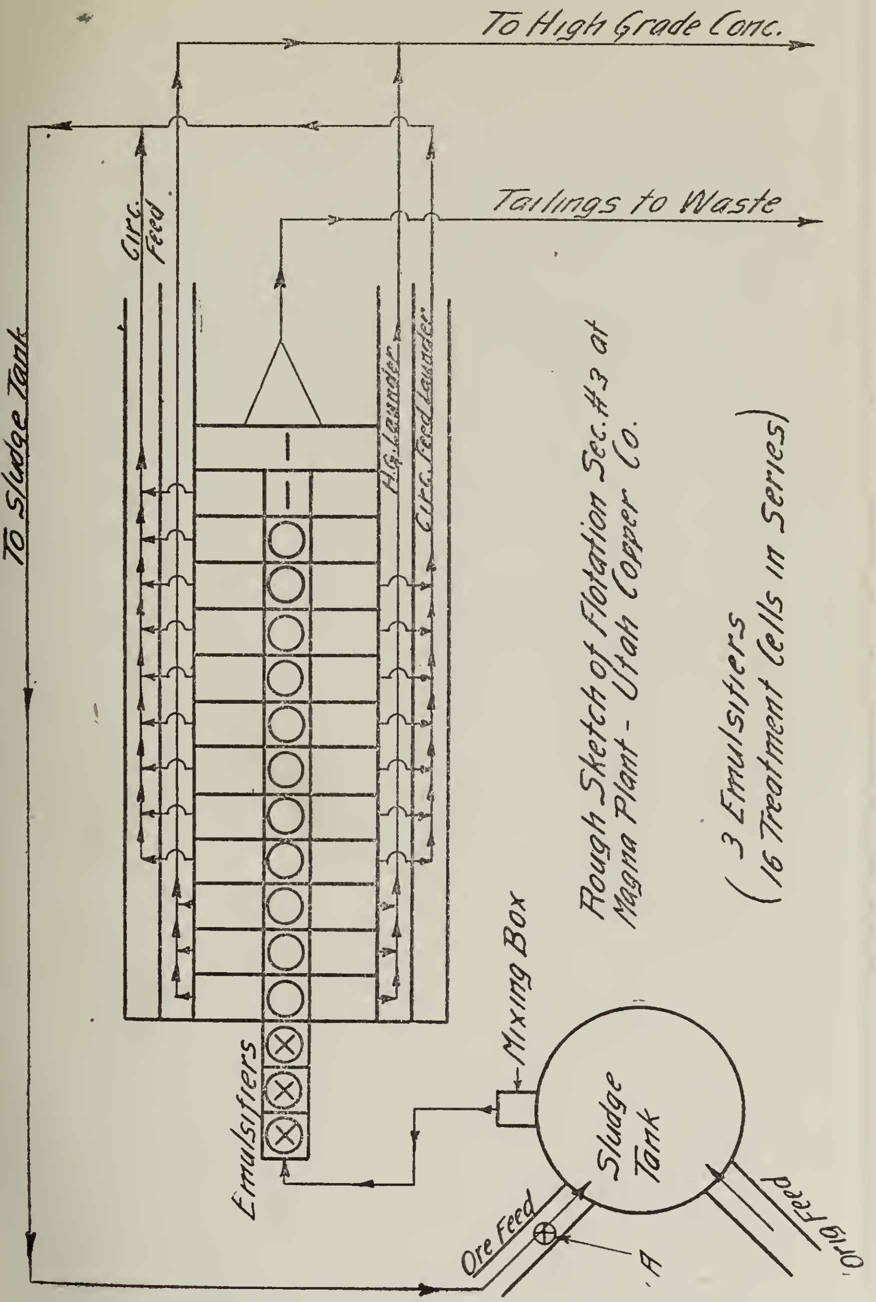
Period December 25, 1916 and April 7, 1917, Inclusive

Pounds New Oil Added	Lbs. Oil in Circulation	Excess Lbs. Circulating Oil	Total Lbs. Oil—New, Plus Excess	Pounds New Oil Per Ton	Pounds Circulating Oil Per Ton	Lbs. Excess Circulating Oil Per Ton	Total Lbs. Oil Per Ton New, Plus Excess	Dry Tons Pulp in Circulation	Per Cent Solids	Total Lbs. Reagent	Lbs. Reagent Per Ton
63883			63883	15.93			15.93		35.160	8462	2.11
528760	103358	103358	632118	18.41	7.02	3.60	22.01	2555	32.736	71282	2.48
296607	311612	311612	608219	11.32	11.89	11.89	23.21	7372	31.021	94899	3.62
465352	241859	179564	644916	14.88	7.74	5.74	20.62	3599	29.438	111975	3.58
112401	20818	9603	122004	14.81	2.74	1.27	16.08	599	32.165	26023	3.43
1467003	677647	604137	2071140					14125		312641	
14106	6516	5809	19915	15.001	6.929	6.178	21.179	136	31.276	3006	3.197

R. A. CONRADS,

Metallurgical Engineer.

Defendant's Exhibit No. 37.



Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Defendant's

UTAH COPPER COMP...

METALLURGICAI

Statement Showing Loss in Founds of Copper and Consequent Monetary Losses Due to
—Comparisons Being Made Between a Normal Period from December 25, 19
—Copper Figured a

DATE	Avg. Lbs. Oil Used Per Ton Ore Treated	Avg. Dry Tons Treated Per Day	Average % Cu. in Tailing	Average % Cu. in Concent.	Average % Fe. in Concent.	Average % Si02 in Concent.	Ratio of Concentration	Average Tons Tailing Per Day	Average % Cu. in Tailing	Loss Lbs. Cu. Per Ton	Loss Per Ton @ 15c Cu.	P. (a
NORMAL												
12/25/16 to 3/24/17*	22.18	926	.120	29.09	21.04	16.99	4.44	715	.120	2.40	.360	
March 25 *A	16.17	1075	.241	27.29	23.27	13.27	4.37	829	.241	4.82	.723	
March 26 *A	15.84	1083	.278	28.45	22.00	14.63	4.34	833	.278	5.56	.834	1
March 27	16.33	1021	.249	24.65	22.86	16.90	4.18	777	.249	4.98	.747	
March 28	16.41	1013	.300	23.12	24.01	16.80	3.84	749	.300	6.00	.900	1
March 29	NO TESTS MADE											
March 30	10.63	750	.589	24.39	20.10	25.40	4.67	590	.589	11.78	1.767	.
March 31 *B	10.33	991	.486	24.75	23.51	18.17	4.36	764	.486	9.72	1.458	
April 1	5.16	1098	.560	21.78	21.98	22.63	3.76	806	.560	11.20	1.680	.
April 2 *C	4.16	1086	1.277	27.09	19.58	23.32	4.40	839	1.277	25.54	3.831	.

* Dec. 25, 1916, to Jan. 16, 1917, inclusive, no oil credited from circulation. Jan. 17th to March 3rd, inclusive, all circulated oil credit
March 4th to 24th, inclusive, circulated oil in excess of 20 lbs. per ton dry pulp in circulation, credited as new oil

* A Inclusive of the circulating oil in excess of 15 lbs. per ton of dry pulp in circulation.

* B Inclusive of the circulating oil in excess of 10 lbs. per ton of dry pulp in circulation.

* C Inclusive of the circulating oil in excess of 5 lbs. per ton of dry pulp in circulation.

Magna Utah.
April 16, 1917.

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

hibit No. 38.

NY—MAGNA PLANT

DEPARTMENT

\bnormal Tailing Caused by Variation in Amounts of Oil Used per Ton of Ore Treated.
16, to March 24, 1917—And Abnormal Days from March 25 to April 2, 1917.
t Various Prices.

Loss -r Ton 20c Cu.	Loss Per Ton @ 25c Cu.	Loss Per Ton @ 30c Cu.	Abnormal Loss Lbs. Cu. Per Ton Tailing	Abnormal Loss Per Ton @ 15c Cu.	Abnormal Loss Per Day @ 15c Cu.	Abnormal Loss Per Ton @ 20c Cu.	Abnormal Loss Per Day @ 20c Cu.	Abnormal Loss Per Ton @ 25c Cu.	Abnormal Loss Per Day @ 25c Cu.	Abnormal Loss Per Ton @ 30c Cu.	Abnormal Loss Per Day @ 30c Cu.
.480	.600	.720									
.964	1.205	1.446	2.42	.363	300.93	.484	401.24	.605	501.54	.726	601.85
.112	1.390	1.668	3.16	.474	394.84	.632	526.46	.790	658.07	.948	789.68
.996	1.245	1.494	2.58	.387	300.70	.516	400.93	.645	501.16	.774	601.40
.200	1.500	1.800	3.60	.540	404.46	.720	539.28	.900	674.10	1.080	808.92
356	2.945	3.534	9.38	1.407	830.13	1.876	1106.84	2.345	1383.55	2.814	1660.26
944	2.430	2.916	7.32	1.098	838.87	1.464	1118.50	1.830	1398.12	2.196	1677.74
240	2.800	3.360	8.80	1.320	1063.92	1.760	1418.56	2.200	1773.20	2.640	2127.84
108	6.385	7.662	23.14	3.471	2912.17	4.628	3882.89	5.785	4853.62	6.942	5824.34

d as new oil.

Defendant E

UTAH COPPER C
METALLURG

Composite Flotation Retreatment Pla

DATE	HEADING Dry Tons	HEADING % Cu.	HEADING % Fe.	HEADING % Si02	TAILING Dry Tons	TAILING % Cu.	TAILING % Fe.	CONCENTRATE Dry Tons	CONCENTRATE % Cu.	CONCENTRATE % Fe.	CONCENTRATE % Si02	Ratio of Concent'n
12/25	340	4.77	3.75	83.47	284	.110	.33	56	28.60	19.05	20.80	6.11
12/26	92	4.37	2.92	88.00	82	.085	.37	10	39.53	12.72	17.00	9.20
12/27	572	5.59	2.55	85.00	488	.087	.37	84	37.34	13.39	22.80	6.77
12/28	715	5.95	2.97	84.20	598	.193	.29	117	35.55	14.60	22.13	6.14
12/29	794	6.56	3.90	81.53	644	.264	.30	150	33.58	17.03	19.33	5.29
12/30	746	6.34	3.93	81.87	593	.074	.33	153	30.64	17.67	21.13	4.88
12/31	752	5.73	4.68	81.00	595	.067	.30	157	27.28	20.57	21.80	4.80
Total	4011				3284			727				
Average	573	5.616	3.529	83.58	469	.126	.327	104	33.218	16.433	20.713	6.170

Magna, Utah,
February 3, 1917.

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

h it No. 39.

N —MAGNA PLANT
D PARTMENT

lt —December 25th to 31, 1916, Inclusive

OIL — ORIGINAL FEED: Lbs. Oil Entering Head of Machine	OIL — ORIGINAL FEED: Lbs. Oil Per Ton	Circulating Feed % Solids	Oil Combination	No. of Cells Producing Finished Concentrate	No. of Cells Circulating	REAGENTS: Total Lbs.	REAGENTS: Pounds Per Ton
5,242	15.42	26.83	95% J; 5% Yar. P. ‡	3-5	13-11	759	2.23
1,451	15.77	No Sample	"	4	12	392	4.26
6,551	11.45	33.05	"	4	12	1135	1.98
9,361	13.09	34.33	"	4-6	12-10	1230	1.72
11,051	13.92	38.42	"	4-6	12-10	1686	2.12
14,642	19.63	39.44	"	4-6	12-10	1657	2.22
15,585	20.72	38.88	"	5	11	1603	2.13
63,833						8462	
9,126	15.93	35.16				1209	2.11

‡ Oils Initialed:
J—Jones.
Y—Yaryan Pine.

Defendant's Ex

UTAH COPPER COMPA

METALLURGICAL

Composite Flotation Retreatment Pla

DATE	HEADING				TAILING			CONCENTRATE				Ratio of Concen-tration	Per Cent Indicated Extrac-tion	O I		
	Dry Tons	% Cu.	% Fe.	% Si02	Dry Tons	% Cu.	% Fe.	Dry Tons	% Cu.	% Fe.	% Si02			Pounds New Oil Added	Lbs. Oil in Circu-lation	Total Oil - Entering Head of Machine
1	739	5.97	4.13	81.33	583	.084	.32	156	27.98	18.87	22.00	4.74	98.92	15724		15724
2	811	6.50	3.57	80.27	653	.094	.30	158	33.04	16.17	22.33	5.14	98.84	17643		17643
3	839	6.08	3.80	82.67	678	.065	.33	161	31.35	17.67	20.80	5.20	99.16	17503		17503
4	863	6.87	3.40	82.13	705	.092	.32	158	37.20	15.27	19.13	5.47	98.90	18064		18064
5	861	6.37	3.22	83.46	703	:148	.31	158	34.01	15.05	30.21	5.44	98.10	18484		18484
6	790	6.37	2.97	81.93	644	.130	.24	146	33.97	14.58	22.03	5.42	98.33	19809		19809
7	896	6.27	3.23	83.20	726	.093	.28	170	32.67	15.13	22.60	5.27	98.82	18691		18691
8	884	5.69	4.43	82.00	703	.112	.31	181	27.41	18.93	23.30	4.89	98.45	18999		18999
9	860	6.21	4.53	80.60	676	.067	.32	184	28.83	17.30	24.47	4.68	99.16	19043		19043
10	838	6.75	4.30	80.00	669	.110	.52	169	33.02	19.70	19.07	4.96	98.69	18855		18855
11	911	6.60	5.48	77.80	703	.107	.32	208	28.57	21.78	18.00	4.38	98.78	18949		18949
12	906	6.80	5.95	77.60	683	.097	.48	223	27.35	20.97	21.20	4.06	98.92	19417		19417
13	880	6.43	5.38	78.33	677	.144	.38	203	27.37	20.74	17.53	4.33	98.23	19276		19276
14	1029	6.45	6.07	76.86	783	.138	.36	246	26.49	22.71	15.55	4.17	98.35	23205		23205
15	940	7.44	4.88	77.70	717	.096	.29	223	31.15	18.58	18.02	4.23	99.05	22356		22356
16	949	6.70	4.86	78.04	715	.055	.35	234	27.10	17.37	25.35	4.07	99.39	20490		20490
17	922	6.72	4.49	78.73	705	.068	.37	217	28.62	16.76	24.95	4.26	99.22	16746	4259	21005
18	948	6.86	4.76	77.74	715	.067	.38	233	27.65	17.27	23.85	4.06	99.26	17336	4970	22306
19	964	6.75	4.62	79.97	746	.060	.28	218	29.57	18.07	21.75	4.41	99.30	15746	6010	21756
20	997	6.98	4.49	78.94	805	.124	.32	192	35.75	18.84	14.47	5.20	98.55	15308	5492	20800
21	994	6.20	4.76	79.90	787	.141	.41	207	29.20	21.60	15.17	4.80	98.17	15560	5967	21527
22	1023	7.15	4.99	78.00	807	.144	.35	216	33.25	20.12	13.57	4.72	98.39	14204	7244	21448
23	979	6.76	5.48	77.26	773	.093	50	206	31.69	20.31	16.07	4.74	98.92	13372	4994	18366
24	982	6.67	5.64	75.86	759	.128	.49	223	28.93	21.67	15.47	4.40	98.54	14228	5278	19506
25	1017	5.75	6.25	76.24	775	.111	.37	242	23.80	24.22	17.14	4.20	98.53	14350	6899	21249
26	1003	6.25	6.12	76.84	762	.089	.40	241	25.67	22.87	17.47	4.15	98.88	14365	5863	20228
27	950	5.42	6.83	75.65	721	.100	.54	229	22.13	24.56	17.88	4.14	98.58	13654	6398	20052
28	966	6.75	6.64	74.80	702	.127	.40	264	24.40	23.68	15.90	3.66	98.66	14212	5005	19217
29	1006	7.01	5.85	76.76	766	.165	.36	240	28.78	21.64	17.12	4.18	98.20	15260	8977	24237
30	986	6.27	7.11	74.54	732	.111	.37	254	24.03	25.59	14.30	3.88	98.67	14632	11817	26449
31	989	6.94	5.48	76.60	770	.124	.56	219	30.86	21.47	13.50	4.51	98.59	13279	14185	27464
Total	28722				22343			6379						528760	103358	632118
Average	927	6.515	4.958	78.766	721	.106	.372	206	29.414	19.664	19.361	4.573	98.727	17057	6891	20391
Avg. to Date	861	6.404	4.783	79.356	674	.109	.366	187	29.803	19.333	19.499	4.768	98.665	15596	6891	18316

Magna, Utah,
February 3, 1917.

‡‡ Oils Initialed:
J—Jones.
Y P—Yaryan Pine.
S F—Smelter Fuel.
A C—American Creosote.

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

hibit No. 40.

NY—MAGNA PLANT

DEPARTMENT

t Results—Month of January, 1917

L										
ORIGINAL FEED			CIRCULATING FEED						REAGENT	
Pounds New Oil Per Ton	Pounds Circulating Oil Per Ton	Total Lbs. Oil Per Ton	Total Tons	Pounds Oil Per Ton in Circulation	Per Cent Solids	Oil Combinations	No. of Cells Producing Finished Concentrate	No. of Cells Circulation	Total Lbs.	Pounds Per Ton
21.28		21.28			38.36	95% J; 5% Y. P. ‡‡	5-6	11-10	1742	2.36
21.75		21.75			37.19	"	5	11	1714	2.11
20.86		20.86			37.80	"	4-5	12-11	1430	1.70
20.93		20.93			39.50	"	5	11	1882	2.18
21.47		21.47			40.02	"	5-6	11-10	1574	1.83
25.07		25.07			38.50	97% J; 3% Y P.	4-6	12-10	1575	1.99
20.86		20.86			40.24	97.5% J; 2.5% Y. P.	5-6	11-10	2106	2.35
21.49		21.49			39.31	97% J; 3% Y. P.; 98% J; 2% Y. P.	5-6	11-10	1743	1.97
22.14		22.14			39.81	"	5-6	11-10	1992	2.32
22.50		22.50			36.31	98% J; 2% Y. P.	5-6	11-10	1715	2.05
20.80		20.80			39.92	"	5-6	11-10	1836	3.02
21.43		21.43			37.80	"	4-6	12-10	1760	1.94
21.90		21.90			38.11	"	3-6	13-10	1855	2.11
22.55		22.55			32.20	"	2-3-6	14-13-10	2722	2.64
23.78		23.78			29.42	98% J; 2% Y. P.; 83% S. F.; 15% A. C.; 2% Y. P.	2-5	14-11	2907	3.09
21.59		21.59			26.80	83% S. F.; 15% A. C.; 2% Y. P.	2-3	14-13	1818	1.92
18.16	4.62	22.78	125	34.07	25.82	"	2	14	1632	1.77
18.29	5.24	23.53	208	23.89	25.52	"	2-3-4	14-13-12	3106	3.28
16.33	6.23	22.56	164	36.65	24.26	83% S. F.; 15% A. C.; 2% Y. P.; 100% S. F.	2-3-4	14-13-12	2287	2.37
15.35	5.51	20.86	106	51.81	28.11	100% S. F.—82.35% S. F.; 17.65% J.	3-4	13-12	2517	2.52
15.65	6.00	21.65	173	34.49	32.52	82.35% S. F.; 17.65% J; 89% S. F.; 11% J.	3-4-5-	13-12-11	2044	2.06
13.88	7.08	20.96	165	43.90	29.58	89% S. F.; 11% J; 98% J; 2% Y. P.	2-3-4-	14-13-12	3557	3.48
13.66	5.10	18.76	134	37.27	28.41	98% J; 2% Y. P.	2-3	14-13	2942	3.00
19.86	5.37	19.86	156	33.83	29.88	"	2-3	14-13	2498	2.54
14.11	6.78	20.89	160	43.12	29.18	"	2-	14	2702	2.66
14.32	5.85	20.17	154	38.07	26.78	"	2-3	14-13	2814	2.80
14.37	6.73	21.10	128	49.98	27.91	"	2	14	2533	2.67
14.71	5.18	19.89	180	27.81	28.70	"	2	14	2804	2.90
15.17	8.92	24.09	181	49.60	27.70	"	2-3-4	14-13-12	3262	3.24
14.84	11.98	26.82	233	50.72	29.82	"	2	14	3073	3.12
13.43	14.34	27.77	288	49.25	29.34	"	2	14	3140	3.17
			2555						71282	
18.41	7.02	22.01	170	40.45	32.736				2299	2.48
18.11	7.02	21.27	170	40.45	33.036				2099	2.43

R. A. CONRADS,
Metallurgical Engineer.

Defendant's E

UTAH COPPER COMP

METALLURGICA

Composite Flotation Retreatment Pla

DATE	HEADING Dry Tons	HEADING % Cu.	HEADING % Fe.	HEADING % Si02	TAILING Dry Tons	TAILING % Cu.	CONCENTRATE Dry Tons	CONCENTRATE % Cu.	CONCENTRATE % Fe.	CONCENTRATE % Si02	Ratio of Concentration	Per Cent Indicated Extraction	Pounds New Oil Added	Lbs. Oil in Circulation	Total Enter Head Mach
1	915	7.02	4.85	78.30	729	.136	186	33.99	19.24	15.77	4.92	98.44	10382	12142	225
2	941	6.40	5.38	78.04	748	.108	193	30.78	20.44	16.10	4.88	98.68	8615	10654	192
3	947	6.21	6.25	74.18	727	.180	220	26.13	22.24	17.81	4.30	97.83	10007	11628	216
4	955	6.41	5.76	76.30	743	.134	212	28.44	22.26	17.04	4.51	98.40	9824	12083	219
5	1011	6.70	5.85	76.20	779	.088	232	28.93	22.59	16.00	4.36	99.02	8791	9501	182
6	943	6.34	6.58	75.10	724	.107	219	26.94	24.49	13.67	4.30	98.71	11275	6888	181
7	956	6.43	5.61	77.53	749	.095	207	29.39	22.43	14.77	4.62	98.83	13232	9317	225
8	985	6.30	5.77	77.40	767	.102	218	28.10	23.43	13.87	4.52	98.75	12727	9184	219
9	992	6.61	5.34	78.10	781	.131	211	30.66	21.21	14.67	4.71	98.46	13099	10314	234
10	939	7.05	6.03	76.50	708	.129	231	28.28	22.50	15.77	4.07	98.59	11863	10749	226
11	909	7.48	5.48	76.53	702	.106	207	32.46	21.33	13.60	4.39	98.92	12874	9555	224
12	881	7.55	5.88	75.23	665	.103	216	30.45	22.37	12.50	4.08	99.00	12245	9194	214
13	915	6.91	7.76	74.17	678	.094	237	26.42	25.16	12.30	3.86	99.01	11687	15767	274
14	917	7.65	5.57	74.90	705	.108	212	32.66	22.06	12.77	4.32	98.92	9739	11567	213
15	958	7.13	6.60	74.20	724	.122	234	28.77	24.43	13.73	4.09	98.68	9211	15870	250
16	876	7.46	6.47	74.55	665	.127	211	30.54	23.41	11.57	4.15	98.68	8125	10232	183
17	904	7.33	6.73	73.70	677	.148	227	28.73	23.74	11.98	3.98	98.47	8885	12734	216
18	917	8.07	5.37	75.07	706	.140	211	34.58	21.06	12.10	4.34	98.67	8839	10294	191
19	924	7.20	6.70	74.23	702	.140	222	29.56	23.80	12.20	4.17	98.54	8645	11886	205
20	919	7.59	5.62	75.13	700	.161	219	31.40	21.70	14.03	4.20	98.40	8924	11272	201
21	951	7.38	6.21	75.63	719	.112	232	29.82	22.71	14.15	4.09	98.86	8738	14660	233
22	915	7.07	5.96	75.72	702	.159	213	29.87	22.86	13.60	4.30	98.28	7783	20332	281
23	916	6.83	6.09	76.27	703	.114	213	29.01	23.67	13.03	4.30	98.68	7170	15277	224
24	967	6.46	5.89	76.77	744	.120	223	27.65	23.31	14.50	4.34	98.59	7124	12631	197
25	911	6.32	6.37	76.27	699	.127	212	26.69	23.51	13.07	4.29	98.45	12067	12533	246
26	906	6.48	5.79	76.43	705	.112	201	28.78	22.01	14.70	4.50	98.65	13153	4402	175
27	956	6.79	6.09	76.13	722	.094	234	27.48	22.31	16.08	4.09	98.92	14107	4741	188
28	980	6.73	6.78	74.07	718	.102	262	24.92	23.58	14.62	3.74	98.92	17476	6205	236
Total	26206				20091		6115						296607	311612	6082
Average	936	6.9161	6.028	75.808	717.5	.1212	218.4	29.241	22.637	14.143	4.294	98.655	10593	11129	217
Avg. to Date	893	6.636	5.337	77.779	693	.114	200	29.587	20.861	17.022	4.519	98.666	13474	6288	197

Magna, Utah,
March 2, 1917.

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

hibit No. 41.

ANY—MAGNA PLANT
DEPARTMENT
t Results—Month of February, 1917

I L											
	ORIGINAL FEED			CIRCULATING FEED						REAGENT	
il g f e	Pounds New Oil Per Ton	Pounds Circulating Oil Per Ton	Total Lbs. Oil Per Ton	Total Tons	Pounds Oil Per Ton in Circulation	Per Cent Solids	Oil Combinations	No. of Cells Producing Finished Concentrate	No. of Cells Circulating	Total Lbs.	Pounds Per Ton
4	11.35	13.27	24.62	259	46.88	32.03	98% J; 2% Y. P. ‡	4	12	3010	3.29
	9.16	11.32	20.48	323	32.98	33.17	"	2	14	2973	3.16
	10.57	12.28	22.85	325	35.78	32.14	"	2	14	2589	2.73
7	10.29	12.65	22.94	321	37.64	31.24	"	2	14	2925	3.06
2	8.70	9.40	18.10	335	28.36	30.92	"	2	14	2777	2.75
3	11.96	7.30	19.26	278	24.78	32.35	98% J; 2% Y. P.; 80% J; 20% A. C.	2-4	14-12	3122	3.31
	13.84	9.75	23.59	184	50.64	31.43	80% J; 20% A. C.; 87½% J; 11½% A. C.; 1% Y. P.	2-4	14-12	3233	3.38
	12.92	9.32	22.24	242	37.95	31.27	87½% J; 11½% A. C.; 1% Y. P.	4-7	12-9	3624	3.68
	13.20	10.40	23.60	228	45.24	30.96	"	4-6	12-10	3037	3.06
	12.63	11.45	24.08	236	45.55	30.77	(87½% J; 11½% A. C.; 1% Y. P.; 42% J. (52% S. F.; 5½% A. C.; ½% Y. P.	4-6	12-10	3261	3.47
	14.16	10.51	24.67	262	36.47	29.12	87½% J; 11½% A. C.; 1% Y. P.	4	12	3233	3.56
	13.90	10.44	24.34	271	33.93	27.11	"	4-5	12-11	3448	3.91
4	12.77	17.23	30.00	273	57.75	30.38	"	4-5	12-11	3241	3.54
6	10.62	12.61	23.23	266	43.48	31.68	"	4-5	12-11	3448	3.76
1	9.61	16.57	26.18	305	52.03	31.66	"	4-5	12-11	3177	3.32
7	9.28	11.68	20.96	327	31.29	32.29	"	4-6	12-10	3317	3.79
9	9.83	14.09	23.92	334	38.12	31.02	"	4-5	12-11	3451	3.82
3	9.64	11.23	20.87	310	33.21	32.24	"	4-5	12-11	3714	4.05
1	9.36	12.86	22.22	321	37.03	33.47	"	4-5	12-11	3531	3.82
6	9.71	12.27	21.98	279	40.40	32.83	"	4-6	12-10	3961	4.31
8	9.19	15.42	24.61	296	49.53	31.90	"	4-6	12-10	3663	3.85
5	8.51	22.22	30.73	284	71.59	30.26	"	4-6	12-10	4319	4.72
7	7.83	16.68	24.51	259	58.98	30.10	"	4-5	12-11	4398	4.80
	7.37	13.06	20.43	254	49.73	27.98	"	4-6	12-10	3532	3.65
	13.25	13.75	27.00	176	71.21	29.64	"	4-6	12-10	3765	4.13
	14.52	4.86	19.38	131	33.60	30.57	"	4-6	12-10	3550	3.92
8	14.76	4.96	19.72	143	33.15	29.98	"	6-8	10-8	3307	3.46
1	17.83	6.33	24.16	150	41.37	30.08	"	6-8	10-8	3293	3.36
9				7372						94899	
2	11.32	11.89	23.21	263	42.27	31.021				3389	3.62
2	15.09	7.04	22.13	150	41.92	32.140				2646	2.96

‡ Oils Initialed:
J—Jones.
Y P—Yaryan Pine.
S F—Smelter Fuel.
A C—American Creosote.

R. A. CONRADS,
Metallurgical Engineer.

Defendant's

UTAH COPPER CO

METALLURGI

Composite Flotation Retreatment

DATE	HEADING Dry Tons	HEADING % Cu.	HEADING % Fe.	HEADING % SiO2	TAILING Dry Tons	TAILING % Cu.	CONCENTRATE Dry Tons	CONCENTRATE % Cu.	CONCENTRATE % Fe.	CONCENTRATE % SiO2	Ratio of Concen-tration	Per Cent Indicated Extraction	Pounds New Oil Added	Lbs. Oil in Circu-lation	Debit
3/1	1 011	6.77	5.45	77.43	772	.087	239	28.37	20.90	17.27	4.23	99.01	15675	6988	
2	954	6.66	4.78	78.80	754	.086	200	31.43	20.04	15.47	4.77	98.95	15147	5482	
3	1 054	6.33	4.61	79.30	826	.072	228	29.02	21.11	17.57	4.62	99.13	17188	6216	
4	995	6.18	5.69	77.50	763	.177	232	25.89	21.29	18.47	4.28	97.80	17989	5333	2240
5	1 006	6.83	5.70	76.37	758	.220	245	27.09	21.40	19.37	4.06	97.60	18845	7079	2740
6	986	6.43	5.39	78.80	772	.208	214	28.91	20.68	17.43	4.61	97.45	16913	6994	2060
7	1 024	7.80	5.69	75.50	763	.189	261	30.04	19.30	18.47	3.92	98.20	16819	8223	2780
8	1 080	7.97	5.96	74.80	800	.243	280	30.06	21.26	15.43	3.86	97.77	17327	6594	2360
9	1 111	6.66	6.92	74.50	835	.183	276	26.25	23.15	16.07	4.02	97.93	18063	7606	2760
10	1 057	7.43	6.32	75.00	782	.206	275	27.93	22.86	14.43	3.84	97.96	17297	9641	2540
11	1 060	7.14	6.25	75.67	772	.144	288	25.92	21.93	17.88	3.68	98.53	17404	13982	3840
12	1 044	7.68	5.74	76.18	762	.100	282	28.15	19.18	22.72	3.70	99.07	18030	12586	3700
13	988	7.25	5.64	76.00	748	.134	240	29.36	20.46	17.50	4.11	98.58	17114	13267	3800
14	965	6.25	5.73	77.03	751	.073	214	27.91	21.91	15.47	4.51	99.08	14695	18453	3200
15	954	5.87	5.45	77.83	760	.083	194	28.56	22.07	17.37	4.92	98.86	12958	12720	2900
16	942	5.76	5.75	78.13	738	.102	204	26.25	23.47	14.53	4.62	98.60	11851	9594	2460
17	958	6.00	5.70	77.33	738	.130	220	25.67	22.08	18.60	4.35	98.37	11559	12028	2800
18	964	5.96	6.04	77.30	748	.104	216	26.24	22.23	17.17	4.46	98.65	12428	10831	2840
19	1 031	6.11	5.94	76.12	789	.164	242	25.50	22.38	17.63	4.26	97.93	12768	11656	3520
20	1 019	7.04	5.87	76.10	779	.123	240	29.44	20.48	17.10	4.24	98.64	13654	8420	2720
21	1 043	6.39	6.60	76.15	799	.111	244	26.97	22.15	14.95	4.28	98.66	16633	7305	2160
22	986	6.10	5.52	77.87	775	.092	211	28.19	20.84	16.60	4.68	98.83	15706	7661	1960
23	1 090	6.40	5.55	78.37	860	.095	230	29.94	20.66	15.08	4.73	98.85	15938	6924	1960
24	1 052	6.35	6.08	77.13	814	.134	238	27.62	22.76	13.60	4.42	98.40	16326	7352	2180
25	1 075	6.43	6.25	75.90	829	.241	246	27.29	23.27	13.27	4.37	97.12	11473	7589	1680
26	1 083	6.77	5.95	75.93	833	.278	250	28.45	22.00	14.63	4.34	96.85	11960	6776	1575
27	1 021	6.08	6.51	76.13	777	.249	244	24.65	22.86	16.90	4.18	96.83	16669		
28	1 013	6.24	7.05	74.73	749	.300	264	23.12	24.01	16.80	3.84	96.42	16622		
29	959	6.78	6.22	75.90	705	.198	254	25.09	22.08	20.07	3.78	97.81	14456	1514	840
30	750	5.69	5.25	78.13	590	.589	160	24.39	20.10	25.40	4.67	91.88	7974		
31	991	6.05	6.41	75.10	764	.486	227	24.75	23.51	18.17	4.36	93.80	7871	3045	680
Total	31 266				23915		7358						465352	241859	62295 1
Average	1 008.58	6.580	5.871	76.678	771.4	.1774	237.4	27.371	21.691	17.143	4.261	97.894	15011	8638	2010
Avg. to Date	930	6.610	5.522	77.397	718	.137	212	28.794	21.158	17.065	4.335	98.395	13965		

465352+241859=............

** Oils Initialed:

L F—Lyoth Fuel.
J—Jones.
Y P—Yaryan Pine.
A C—American Creosote.

Magna, Utah,
April 8, 1917.

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Exhibit No. 42.

MPANY—MAGNA PLANT
AL DEPARTMENT
Plant Results—Month of March, 1917

	OIL											
		ORIGINAL FEED			CIRCULATING FEED						REAGENTS	
Credit	Total Oil Entering Head of Machine	Pounds New Oil Per Ton	Pounds Circulating Oil Per Ton	Total Lbs. Oil Per Ton	Total Tons	Pounds Oil per Ton in Circulation	Per Cent Solids	Oil Combinations	No. of Cells Producing Finished Concentrate	No. of Cells Circulating	Total Lbs.	Pounds Per Ton
6988	22663	15.50	6.91	22.41	149	46.90	25.13	87½% J., 11½% A. C., 1% Y. P. **	6-7	10-9	3188	3.15
5482	20629	15.87	5.75	21.63	109	50.29	27.43	"	6-8	10.8	3486	3.65
6216	23404	16.30	5.90	22.20	136	45.71	28.49	86% J., 12½% A. C., 1½% Y. P.	6-8	10-8	3136	2.98
3093	21082	18.08	3.11	21.19	112	47.62	30.91	Lyoth Fuel Oil.	6-7	10-9	3839	3.86
4339	23184	18.73	4.31	23.04	137	51.67	31.06	" " "	6-8	10-8	4661	4.63
4934	21847	17.15	5.00	22.15	103	67.90	32.02	" " "	6-10	10-6	4092	4.15
5443	22262	16.42	5.32	21.74	139	59.16	29.31	" " "	6-7	10-9	3834	3.74
4234	21561	16.04	3.92	19.96	118	55.88	32.56	" " " & 59% L. F., 41% J.	6-11	10-5	4311	3.99
4846	22909	16.26	4.36	20.62	138	55.12	34.18	59% Lyoth Fuel & 41% J.	7-11	9-5	4511	4.06
7101	24398	16.36	6.72	23.08	127	75.91	29.19	59% L. F., 41% J; 86% J., 12½% A. C., 1½% Y. P.	6-8	10-8	4216	3.99
10142	27546	16.42	9.57	25.99	194	72.07	28.84	86% J., 12½% A. C., 1½% Y. P. 43% L. F. 43% J. 12½% AC 1½% Y. P.	8-9	8-7	3546	3.34
8886	26916	17.27	8.51	25.78	185	68.03	26.14	43% J., 43% L. F. 12½% A. C., 1½% Y. P	6-9	10-7	3062	2.93
9467	26581	17.32	9.58	26.90	190	69.83	26.43	43% J., 43% L. F. 12½% A. C., 1½% Y. P.	6-10	10-6	3419	3.46
15253	29948	15.23	15.81	31.04	160	115.33	25.93	"	6-8	10-8	2912	3.02
9820	22778	13.58	10.29	23.87	145	87.72	25.57	"	6-8	10-8	2902	3.04
7134	18985	12.58	7.57	20.15	123	78.00	25.29	"	6-8	10-8	2403	2.55
9228	20787	12.07	9.63	21.70	140	85.91	26.06	"	6-8	10-8	2617	2.73
7991	20419	12.89	8.29	21.18	142	76.27	26.44	"	6-8	10-8	3060	3.17
8136	20904	12.38	7.89	20.27	176	66.23	26.98	"	6-10	10-6	3961	3.84
5700	19354	13.40	5.59	18.99	136	61.91	27.57	"	6-9	10-7	4056	3.98
5145	21778	15.95	4.93	20.88	108	67.64	26.70	82½% Fuel and 17½% A. C.	7-8	9-8	4153	3.98
5701	21407	15.93	5.78	21.71	98	78.17	25.56	"	5-8	11-8	2656	2.69
4964	20902	14.62	4.55	19.17	98	70.65	26.83	"	6-8	10-8	2411	2.21
5172	21498	15.52	4.92	20.44	109	67.45	28.24	"	8-10	8-6	3229	3.07
5909	17382	10.67	5.50	16.17	112	67.76	31.39	50% J., 37½% F., 12½% A. C.	4-5	12.11	3864	3.59
5201	17161	11.04	4.80	15.84	105	64.53	32.94	"	4-5	12.11	3990	3.68
	16669	16.33		16.33			32.51	"	All	None	4598	4.60
	16622	16.41		16.41			32.64	"	"	"	4741	4.68
674	15130	15.07	.71	15.78	42	36.04	33.44	"	4-16	12-0	3887	4.05
	7974	10.63		10.63			40.52	"	All	None	3584	4.78
2365	10236	7.94	2.39	10.33	68	44.78	36.27	"	5-6	11-10	3553	3.58
179564	644916				3599						111975	
5792	20803	14.837	6.343	21.180	116	49.89	29.438				3612	3.581
6129	20094	15.02	6.59	21.61	139	44.09	31.203				2955	3.177
....	707211											

R. A. CONRADS,
Metallurgical Engineer.

Defendant's E

UTAH COPPER COMP
METALLURGICA

Composite Flotation Retreatment Plant Result

DATE	HEADING Dry Tons	HEADING % Cu.	HEADING % Fe.	HEADING % Si02	TAILING Dry Tons	TAILING % Cu.	CONCENTRATE Dry Tons	CONCENTRATE % Cu.	CONCENTRATE % Fe.	CONCENTRATE % Si02	Per Cent Indicated Extraction	I C
4/1	1098	6.21	6.65	74.80	806	.560	292	21.78	21.98	22.63	93.40	
2	1086	7.14	5.74	76.27	839	1.277	247	27.09	19.58	23.32	86.16	
3	1095	6.23	6.43	76.77	814	.127	281	23.91	22.65	19.47	98.45	
4	1090	5.67	6.22	77.68	830	.116	260	23.38	22.44	19.33	98.41	
5	1104	5.66	6.66	77.10	827	.164	277	22.07	22.89	20.47	97.82	
6	1077	6.15	5.41	78.40	828	.243	249	25.76	21.44	20.50	97.00	
7	1039	7.46	5.48	77.40	789	.307	250	30.10	19.96	18.57	96.89	
TOTAL	7589				5733		1856					
AVERAGE	1084	6.351	6.092	76.910	819	.401	265	24.731	21.618	20.625	95.230	

Magna, Utah,
April 8, 1917.

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

xhibit No. 43.

ANY—MAGNA PLANT
L DEPARTMENT

s for Period—April 1st and 7, 1917—Inclusive

atio of ncentr'n	Pounds New Oil Added	Lbs. Oil in Circulation	Excess Lbs. Circulating Oil	Total Lbs. Oil, New, Plus Excess	Pounds New Oil Per Ton	Pounds Circulating Oil Per Ton	Lbs. Excess Circulating Oil Per Ton	Total Lbs. Oil Per Ton, New, Plus Excess	Dry Tons Pulp in Circulation	Per Cent Solids	Total Lbs. Reagent	Lbs. Reagent Per Ton
3.76	5666			5666	5.16			5.16		37.99	3595	3.27
4.40	4418	354	99	4517	4.07	.33	.09	4.16	51	35.93	3404	3.13
3.90	18450	3310	1430	19880	16.85	3.02	1.31	18.16	94	32.20	3396	3.10
4.19	19527	5019	2959	22486	17.91	4.60	2.71	20.62	103	32.92	2922	2.68
3.99	21499	4010	1430	22929	19.47	3.63	1.30	20.77	129	30.41	3803	3.44
4.32	21829	5177	2617	24446	20.27	4.81	2.43	22.70	128	27.93	4275	3.97
4.16	21012	2948	1068	22080	20.22	2.83	1.03	21.25	94	27.51	4628	4.45
	112401	20818	9603	122004					599		26023	
4.089	16057	2974	1372	17429	14.811	2.743	1.265	16.076	86	32.165	3718	3.429

R. A. CONRADS,
Metallurgical Engineer.

Defendant's Exhibit No. 44.

RAY CONSOLIDATED COPPER COMPANY
HAYDEN PLANT
FLOTATION OPERATIONS
Retreating Vanner Concentrate Products

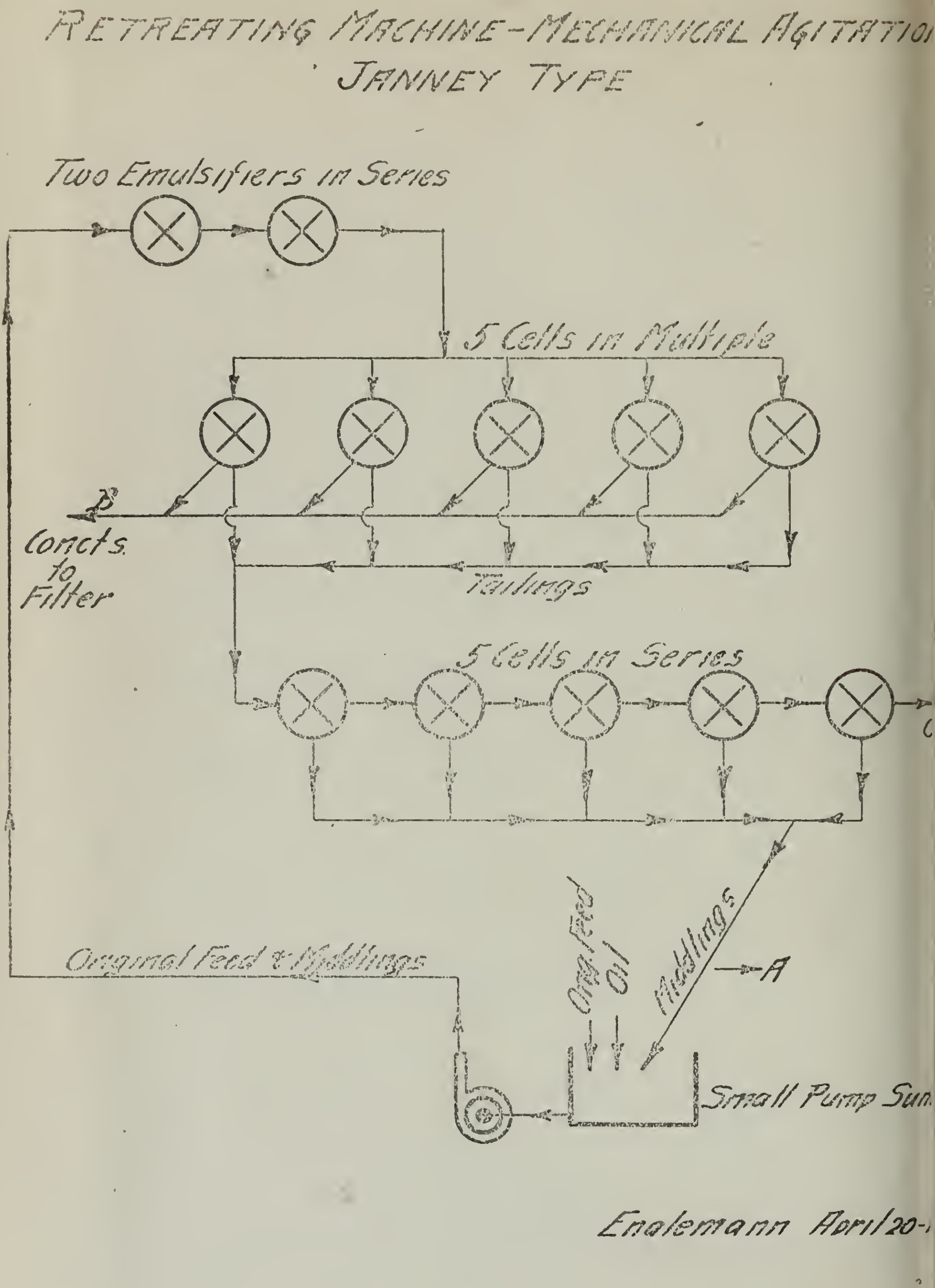
PERIOD	FLOT. HEADS Tons	FLOT. HEADS Assay % Cu.	FLOT. CONCTS. Tons	FLOT. CONCTS. Assay % Cu.	Tails Assay % Cu.	Flotation Copper Appr. %	Flotation Recovery Estm. %	New Oils Lbs. Per Ton	Oil Assays Flotation Heads Including Circul. Load	Percents Concts.	Percents Tails
1914											
4th Quarter	8821	6.87	1892	29.78	.617	92.94	92.94	4.31			
1915											
1st Quarter	17849	6.42	3752	28.94	.425	94.76	94.76	3.47			
2nd Quarter	8802	5.60	1702	27.33	.397	94.28	94.28	5.28			
3rd Quarter	17328	5.73	3797	24.17	.554	92.45	92.45	4.92			
4th Quarter	19558	6.12	4200	26.44	.574	92.64	92.63	4.42			
YEAR	63537	6.029	13451	26.61	.502	93.439	93.436	4.41			
1916											
1st Quarter	20190	4.967	3629	25.37	.496	91.80	91.80	3.34			
2nd Quarter	22750	5.460	4362	26.62	.441	93.47	93.47	3.23			
3rd Quarter	22750	5.840	4767	26.59	.316	95.73	95.73	3.22			
4th Quarter	27275	6.099	6086	26.38	.273	96.52	96.52	3.54			
YEAR	92965	5.630	18864	26.30	.375	94.69	94.69	3.36			
1917											
January	9300	6.24	2267	23.99	.456	94.48	94.48	20.02			
February	8550	6.63	2289	23.63	.422	95.33	95.33	18.77	1.07	2.87	.10
March	11063	6.70	3377	21.07	.368	96.19	96.19	21.19	.97	3.15	.033
1st Quarter Average	28913	6.531	7933	22.76	.412	95.42	95.42	20.10	1.01	3.03	.062

Hayden 3/29/1917
Copied Butte 4/15/1917

(Signed) E. W. ENGELMANN,
Flotation Foreman.

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Defendant's Exhibit No. 45.



Filed May 18, 1917. GEO. W. SPROULE, Cle
By H. H. WALKER, Dep

Plaintiffs' Exhibit No. 46.

Disclaimer in Letters Patent No. 835,120

DISCLAIMER

835,120—Henry Livingstone Sulman, Hugh Fitzalis Kirkpatrick-Picard, and John Ballot, London, England. ORE CONCENTRATION. Patent dated November 6, 1906. Disclaimer filed March 28, 1917, by the assignee, Minerals Separation, Limited.

"Your petitioner, therefore, for the purpose of complying with the requirements of the law in such case made and provided, and of disclaiming those parts of the thing patented which your petitioner does not choose to claim or hold by virtue of said Letters Patent No. 835,120, does hereby disclaim from claims 9, 10 and 11 of said Letters Patent No. 835,120, any process of concentrating powdered ores excepting where the results obtained are the results obtained by the use of oil in a quantity amounting to a fraction of one per cent. on the ore."

(Official Gazette, April 3, 1917.)

Filed May 18, 1917.

GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Defendant's Exhibit No. 47.

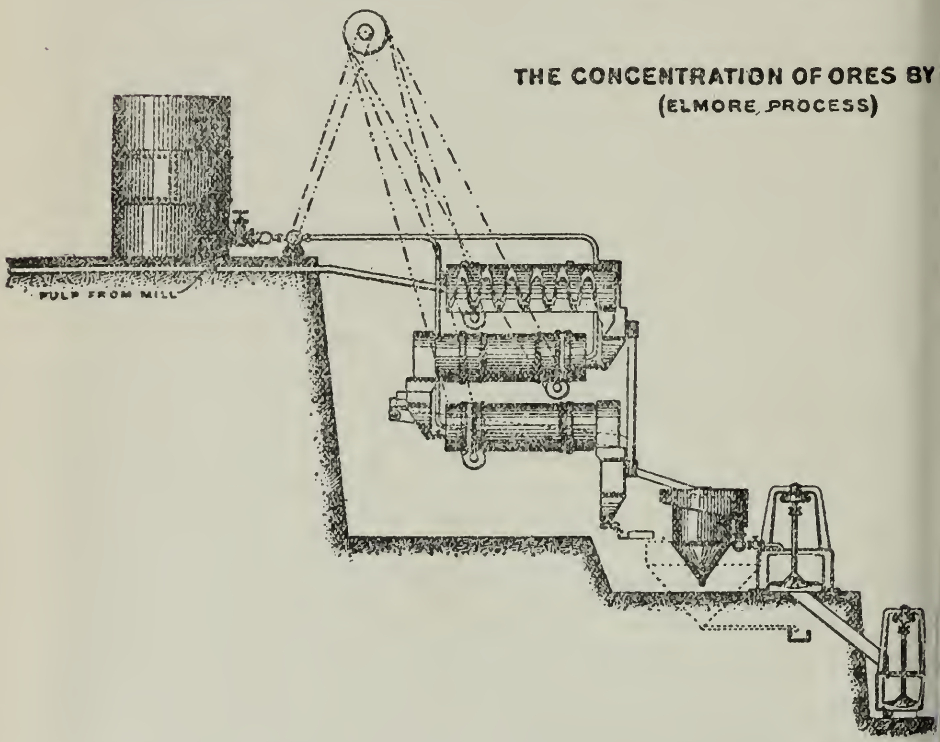
From the California Journal of Technology, November, 1903.

EXPERIMENTS ON THE ELMORE PROCESS OF OIL CONCENTRATION

By W. F. Copeland, Min., '03, Drury Butler, Min., '03, Jas. H. Wise, Min., '03.

Inasmuch as the fundamental ideas underlying the Elmore Process of Oil Concentration are comparatively new, a brief outline of the process as it is in actual operation will first be given.

The process depends upon the fact that minerals



with a metallic lustre, when treated in the form of a wetted pulp, adhere to oil, while earthy minerals do not. Two distinct operations are involved; first the separation of the metallic mineral from the gangue

Defendant's Exhibit No. 47.

by means of the oil; second the extraction of the mineral from the oil.

The ideas underlying the first operation were patented by John Turnbridge of Newark, N. J., in 1878. In 1886 Carrie J. Everson, of Chicago, contributed the idea that the concentration was aided by the presence of an acid solution, and patented the same. But the absence of a successful method of separating the mineral from the oil prevented the practical application of these early patents. Burning the oil was tried, but this left a difficult residue to treat, and the large consumption of oil made the method too expensive. Settling the mineral out by thinning the oil with gasoline, ethers, carbon bisulphide, etc., also proved too expensive, and it was not until July, 1900, that this difficulty was overcome, when Mr. Francis E. Elmore, of Leeds, England, accomplished the separation by means of a centrifugal machine, similar in most respects to those used in sugar factories and in milk and cream separation. This contribution by Mr. Elmore, then, made the process feasible.

The plant, designed by the Oil Concentration Syndicate, and now in successful operation, is shown in the accompanying cut. This plant consists of oil supply tank, long horizontally rotating cylinders, each containing a fixed helical screw inside, separating devices at the end of each cylinder, receiving tanks for mineral laden oil, centrifugal separators, pumps, etc.

The pulp and oil are charged into cylinder No. 1, at "A," simultaneously. By slowly rotating the cyl-

Defendant's Exhibit No. 47.

inder the pulp and oil are brought into thorough contact and carried forward at the same time. From cylinder No. 1 the material is continually discharging into separator No. 1. (These separators are Spitzkasten or hydraulic separators.) Here the mineral laden oil is floated off. The tailings are drawn off at the bottom of the separator and charged into cylinder No. 2 with more oil, and thus the treatment is repeated as many times as necessary, three usually being sufficient. From the last separator the tailings go to the tailings heap. The mineral laden oil collect~~ing~~ed from all the separators is carried to a large receiving tank "B." Here, after being heated in order to thin it and overcome its viscosity, the oil is charged into centrifugal machines, where the concentrates are separated out; the oil, freed from its load of mineral, is pumped back to the original storage tank to be used again.

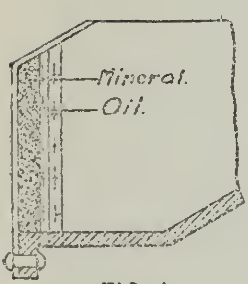


FIG. 1.

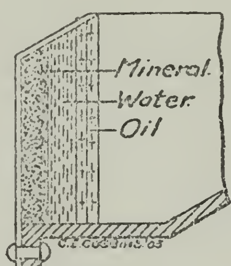


FIG. 2.

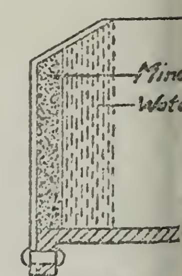


FIG. 3.

The oil commonly used is a heavy residium of consistency of ordinary cylinder oil, with specific gravity about .9, and hence the maximum load it can carry and still float in water is from 100 to 200 lbs. per

Defendant's Exhibit No. 47.

ton. Usually about a ton of oil is kept in operation for each ton of ore, but the losses of oil are small, the recovered oil being used over and over again. With the treatment in the above mentioned plant it is claimed that the losses are not greater than from one to three gallons of oil per ton of ore.

CENTRIFUGAL SEPARATOR (See Fig 4.)

The theory of the separator is illustrated in figures No. 1 to No. 3 inclusive. The oil laden with its mineral (heated to 100°-150° F.) is charged into the centrifugal basket. (C or B, Fig. 4.) When the basket is rotated at high speed (about 5000-6000 peripheral feet per minute) the charge arranges itself according to the specific gravities of the particles, the heavy ones seeking the periphery, as shown in Fig. 1. Water is then added, and this, due to its specific gravity, takes place between the oil and the mineral. Sufficient water is added to displace all the oil, which latter is discharged over the lip of the basket, and collected in a receiver.

If a small quantity of hot water precedes the charge of mineral laden oil, the mineral particles, on seeking the periphery, have to pass through the water and are thus more completely freed from the oil. This idea is illustrated in Fig. 3.

The concentrates are then dried in a second basket (1, Fig. 4) with porous periphery and filter bag. (E, Fig. 4.)

Defendant's Exhibit No. 47.

LABORATORY METHODS.

In making a test, the ore is first crushed to the desired fineness, and the proper charge is thoroughly wetted in the solution to be used (usually water), thus forming a thin pulp. The oil is next added and the whole charge thoroughly mixed. This mixing, or agitation, can be done in two different ways. The charge may be agitated very gently, the oil being kept in a single lake, and broken up as little as possible consistent with a thorough contact of pulp and oil; or the charge may be agitated so violently as to dash the oil

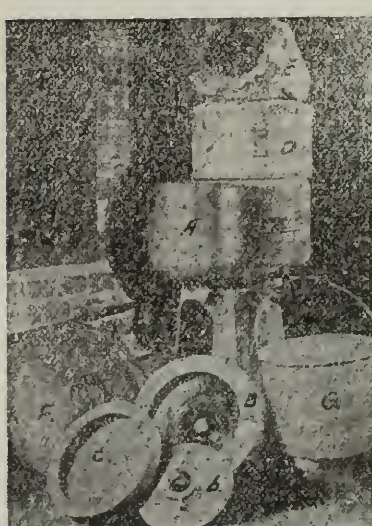


FIG. 4.

FIG. 5.

up into a foam or froth full of air bubbles; thus a very thorough contact of oil and pulp is obtained. Each method has its advantages and disadvantages, and these are discussed later.

Defendant's Exhibit No. 47.

At first the mixing was performed in a galvanized iron mixer. The mineral laden oil was then skimmed off with an aluminum ladle. (Aluminum, if thoroughly wetted, does not adhere to the oil. To wet the same thoroughly, first wash, then dip in strong sulphuric acid, and then wash in water.)

The roughness of the aluminum mixer and the affinity of the oil for the metallic surface makes a thorough clean-up after each test difficult, hence a large clean-up error is always introduced by this method.

Glass, however, behaves towards oil just as the nonmetallic gangue does, (glassware is cleaned up and surface wetted the same as aluminum), and by the use of ordinary percolating tubes, such as shown in figure No. 5 (A and B), the clean-up error may be entirely eliminated. With these, the tailings may be drawn off at the bottom and oil at the top, as desired. Three methods of mixing may be used. 1, By inverting the tube several times, thus allowing the ore to fall through the oil. 2. By rotating the tube in a horizontal position, thus throwing the pulp up on to the surface of the lake of oil. 3. By violently shaking the tube, thus producing the foam effect, or at least shattering the oil into small globules. The charge having been thoroughly mixed, the tailings are allowed to settle, solution is added to float the oil to the top of the tube, whence it may be floated off as shown in figure No. 6.

Defendant's Exhibit No. 47.

The mineral laden oil is then heated and treated in the centrifugal separator as above described. For small tests, a shallow basket, such as is shown at C, in figure No 4, may be used.

The solution used in the concentration is a matter of some importance. Water is, of course, used whenever possible, but certain other solutions have important advantages. As before stated, an acid solution is found advantageous. It cleans the metallic surfaces, by dissolving the metallic oxide coatings that may have formed on them. It increases the specific gravity of the solution, and it aids in producing the foam effect which is due to the generation of certain gases.

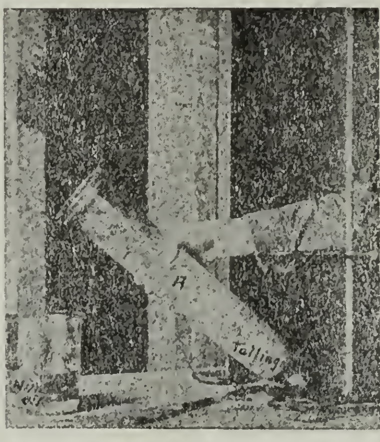


FIG. 6.

As before stated, the specific gravity of the average oil used is about .9 and water .1, leaving a difference of about .1 for buoyancy or carrying capacity of the oil. The idea at once suggests itself that if a denser solution be used, the carrying power of the oil will be increased correspondingly. A salt (NaCl) solution,

Defendant's Exhibit No. 47.

for instance, gives excellent results. A saturated solution of NaCl at 20° C, containing about 27% NaCl, has a specific gravity of 1.204. This gives a difference of .3 between the specific gravities of the oil and of the solution, and a carrying capacity of the oil threefold greater than with water alone. Not only does it give a greater buoyancy to the oil, but it also aids materially in producing the foam effect, and probably aids in brightening the metallic surfaces.

The phenomena of overloading is so vital in the practical application of the process, as well as in the laboratory tests, that it must be thoroughly understood. With oil of specific gravity .9 the maximum possible load of mineral it can carry in water is 200 pounds per ton, while in a saturated salt solution it is 600 pounds per ton. If these limits are exceeded the oil is said to be overloaded and sinks. But it is not necessary that the whole mass of oil in any particular case be charged to this extent in order that overloading take place. If a charge of oil and mineral, safe within the above limits, be allowed to stand, the mineral will settle to the bottom of the oil, and hence in the lower portions of the oil the percentage of mineral may exceed the safe limits. In case the overloading is sufficient to overcome the surface tension of the oil, small masses separate away from the main mass and sink. It is evident, then, that the time allowed for the gangue to settle out of the oil should not be long enough to permit the overloading to take

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place. Small globules of oil separated from the main mass in agitation may also become overloaded.

TESTS—MOLYBDENITE ORE.

The ore treated was low grade, with the values fairly well disseminated. The gangue minerals were orthoclase and quartz. Samples were crushed to 20, 30 and 40 mesh, and treated in percolating tubes as outlined above. The details and results are given in the following table:

MOLYBDENITE

No. of Exp.	Wt. Ore Treated	Mesh	Total amt. of Oil Used	No. of Treat.	Value Conc. % M_oS_2	Value Tails % M_oS_2	% of Extrac.
1	2 kg.	20	2400	4	23.9	.92	6.30
2	2 kg.	30	2400 0	3	23.2	.81	67.6
3	1 kg.	40	1200	3	17.4	.82	67.2
4	100 gms.	30	2.1	1	32.4	1.41	43.5
5	100 gms.	30	5.3	2	32.4	1.30	47.0
6	100 gms.	30	8.9	3	32.4	.62	75.0
7	......	30	3.	1	47.9	......	......
8	......	30	3.	3	27.6	......	......
9	......	30	3.	1	50.0	......	......

Experiment No. 1 showed the presence of middlings, requiring finer crushing to liberate the sulphide. Experiments No. 2 and No. 3 gave practically the same percentage of extraction, but the concentrates in No. 3 were much lower grade than in No. 2. A comparison of values of concentrates in No. 1, No. 2 and No. 3 shows clearly that although the finer crushing has freed the MoS_2 from the gangue, at the same time it has produced a larger percentage of fine gangue which, becoming mechanically occluded in the oil, gives a low grade concentrate.

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Experiments No. 4, No. 5 and No. 6 show the results obtained by treating separate samples with small quantities of oil, in a salt solution, and agitating violently to produce the fóam effect. This method gives the highest grade concentrates of any of the direct treatments here outlined. In experiment No. 6 only about 10c.c. of oil was used for 100 grams of ore. This gave an extraction of 75% with concentrates running 32.4% MoS_2.

But these concentrates were not marketable. In practice they would have to be reconcentrated. The results of a few reconcentration tests follow.

Samples of concentrates running about 26% MoS were agitated in a sulphuric acid solution 15 minutes. This agitation caused considerable of the occluded gangue to free itself. A small quantity of oil was then added and the material reconcentrated, utilizing the foam effect. In No. 9 a concentrate running 50.02 MoS_2 was obtained. Concentrates such as these would probably be marketable. In experiment No. 8 reconcentration was tried without the agitation in sulphuric acid solution, but the results were unsatisfactory.

The experiments on molybdenite ores are of interest because the sulphide of molybdenum has lately come into prominence in the manufacture of molybdenum steel, and also because of the fact that all previous methods of concentration other than hand sorting, have failed in its case.

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COPPER ORES.

The ore treated was the raw product taken directly from a mine in Calaveras County, near Copperopolis. It consisted of chalcopyrite, bornite and pyrite, with a chlorite and amphibolite schist gangue. The copper values were contained in the chalcopyrite and bonite.

A 6 Kg. charge of the ore, previously ground to 40 mesh, was jigged to remove the coarse material; the products being heads, middlings and tails. 1.2 Kg. of the jig tailings was given the following treatment. The charge was thoroughly mixed and wetted in a large percolating tube with about 700 ccs. of water; 5000 ccs. of oil were then added and the whole was gently agitated for 20 minutes. After standing for several minutes the mineral laden oil was floated off, warmed, run through the separator and parted as previously explained. A careful assay of the different products shows the following very satisfactory results:

		Weight.	% Cu.	Cu. Content.	% Extrac.
	Ore	6000 gms	2.73	163.8 gms	
Wet Conc'n.	Heads	575 gms	4.88	28.05 gms	16.7
	Mids	800 gms	4.66	37.23 gms	22.3
	Tails	4625 gms	2.19	101.28 gms	60.8
	Oil Conc	175 gms	13.05	22.83 gms	90.8
	Oil Tails	1025 gms	.23	2.35 gms	9.3

From the above table it is readily seen that over 60% of the copper content lies in the jig tailings, and of this 90% can be extracted by the oil concentration method, with a ratio of concentration of 7:1.

Summarizing the above facts it is seen that by means of the oil concentration method a total (i. e. including jig heads and middlings, and oil concentrates) of 94.2% of the copper in the raw products is recovered, and the bulk of the material containing this copper is but 25.8% of the original ore charge taken.

GOLD ORES.

1. *Auriferous Black Sands.*—Before treating a sample of the auriferous sand, separate samples of the black sand and of free gold were tested to determine the relative affinity of the oil for each.

(a) Magnetic black sands from Cape Mendocino, consisting of magnetite with some quartz and pyrite, were run through a magnetic separator to separate out the magnetite. The latter was treated with oil and, contrary to expectations, the oil, when cold, united readily with the black sand, but dropped it on being warmed. Black sands from Nevada County Hydraulic Mines were treated in the same way, but in this case the black sand showed very little affinity for the oil.

(b) A sample of very fine flour gold from Klondyke undercurrents was next treated. When cold and vicous the oil took up the gold very readily, but on being warmed dropped most of it, just as in the case of the Mendocino black sands.

A sample of rusty flake gold obtained from the Nevada county black sands by panning was next tested with water and oil as above. The oil showed

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very little affinity for the gold in this condition, and the few flakes that were picked up soon dropped. In order to brighten the flakes and remove the rust, a dilute solution of sulphuric acid was used in place of water, but again the gold was only partly taken up by the oil. A dilute solution of potassium cyanide was next tried on a fresh sample of the gold flakes, but no improvement was noticed. The flakes were next lightly coated with mercury and in this condition they were readily taken up by the oil.

(c) A test was made upon mercury to see how the oil would act upon it. When in the condition of coarse globules, the mercury was not taken up by the oil. Upon violent agitation, however, the mercury floured, and in this condition was readily picked up by the oil. The tendency toward overloading the oil was strong on account of the high specific gravity of the mercury, and much oil had to be used.

2. *Quartz Gold Ores.*—(a) A representative sample of unoxidized mother lode ore was obtained from Tuolumne county. About 75% of the values were in the suphurets, as shown by amalgamation and concentration at the mine. The ore, crushed to 40 mesh, was treated in a ½% sulphuric acid solution with oil in the ratio of 1000 ccs. of oil per kilo of ore. Owing to lack of facilities at the mine, where these tests were made, the concentrates could not be separated from the oil, hence the extraction was determined by the method of difference.

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TUOLUMNE ORE.

The original ore assayed gold	$2.26 per ton
The tailings assayed	.31 per ton
Extraction	1.95 per ton

or 86.28% of original assay value of ore. This compares favorably with the total average extraction of 80% to 90% obtained by amalgamation and concentration at the mine.

(b) Two samples of ore were received from a mine near Folsom, Cal. The ore consisted of quartz with a small percentage of pyrite and chalcopyrite and some free gold. The sulphurets were badly oxidized. The treatment and results obtained are shown in the table following:

FOLSOM ORE.

Mesh.	Wt. Ore.	Vol. Oil. cc.	Wt. Conc.	Value Ore.	Value Conc.	Value Tails.	% of Extrac.
30	500 gm	500	24	$21.50	$105.80	$11.57	23.6
30	500 gm	500	58	21.50	151.36	8.46	81.7
50	500 gm	500	52.5	21.50	157.00	7.86	76.6
50	500 gm	500	48.5	21.50	185.08	3.52	83.7
30	1000 gm	1000	20.5	39.50	527.50	17.45	27.4
60	100 gm	100	10	31.50	240.00	12.00	60.7
80	100 gm	100	12	39.50	255.00	9.40	77.5

No. of treatments in each case, 3.

Solution used in Nos. 1, 3, 5, 6, 7, was water; in Nos. 2 and 4 it was 1% H_2SO_4.

Weight tails=weight ore—weight concentrates.

(c) A sample of gold ore from Tuolumne County, Cal., containing quartz, molybdenite, pyrite and some telluride and free gold was treated. The presence of molybdenite made amalgamation very difficult. The sample, crushed to 30 mesh and treated in water with oil, gave the following extraction:

Ore Wt.	Val. Ore.	Wt. Conc.	Val. Conc.	Wt. Tails.	Val. Tails.	Ratio Conc.	% Ex.
46 gm	$32.70	4.1	$140.26	41.2	$16.40	9.4:1	55.2

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Silver Ores.—A small test was made on a sample of Ruby silver ore from Tonopah. The silver values consisted of proustite, pyrargyrite and some horn silver.

The original ore assayed gold	$ 162.25	
Silver	259.82	
	$ 422.07	
The sample was concentrated in a 20% NaCl solution yielding tails which assayed gold	36.17	
Silver	73.12	
	$ 109.29	
The oil concentrates assayed gold	$ 547.75	
Silver	1092.25	
	$1640.00	per ton

Although the tailings were high, yet 80% of the gold and 75% of the silver was extracted. Further investigation would probably show an improvement over these results.

RESUME.

As a conclusion to the above experiments the following suggestions and inferences are appended:

1. *As Regards the Wetted Pulp.*—As far as could be determined particles with either metallic or non-metallic surfaces when in the dry state, alike adhere to the oil. Furthermore, there is no affinity of oil for water as is shown by the fact that an oiled surface cannot be wetted. Hence if a metallic particle be thoroughly wetted, a water surface and not a metallic surface is exposed to the oil, and the former, as before stated, has no affinity for the oil. It is evident then that the water film must first be

Defendant's Exhibit No. 47.

displaced before the oil and mineral can come in contact with each other. This displacement is hardly probable if the water film is in intimate contact with the particle, and it seems more probable that the differentiation is due to the fact that non-metallic surfaces are, and metallic surfaces are not actually wetted. If this be the case, a careful study of the relative wetting of different surfaces would be an important line of investigation.

2. The ratio of the exposed surface to the weight of the particle should be as large as possible, because the total adhesive force is increased with an increase of the surface exposed to contact with the oil. This condition is best realized when the mineral breaks up into thin flakes. It is evident from this that a knowledge of the fissile character of the minerals in question is important.

3. One fundamental difficulty involved in this process is that it undertakes to concentrate and float a heavy metallic mineral, and sink the lighter gangue minerals, but this point is not necessarily fatal to the process. It is evident, however, that the heavier the gangue and the lighter and more fissile the metallic minerals, the better the ore is adapted to this method of concentration. This is a direct reversal of the ideal conditions for jig or vanner concentration.

4. Another characteristic of the process is the fact that the ratio of concentration is usually small, due to the large amount of gangue occluded by the oil and carried into the concentrates. This difficulty

is increased by sliming the gangue minerals. Sliming of the metallic minerals is no disadvantage.

Foam Effect.—The foam effect is produced by a violent agitation, especially in acid or salt solutions. This throws the oil into a froth, which is heavily charged with air or gases. This gas of course gives a greatly increased buoyant force. The oil in this condition assumes a certain load of mineral and holds it in a very stable condition. The charge does not settle and overload on standing as in the case of the lake effect. The foam effect is best adapted for light, flaky minerals, such as molybdenite.

The work above outlined suggests many lines of further investigation, and as these come to be worked out, the process will become more valuable and of more general application.

Filed May 18, 1917.

GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

(No Model.)

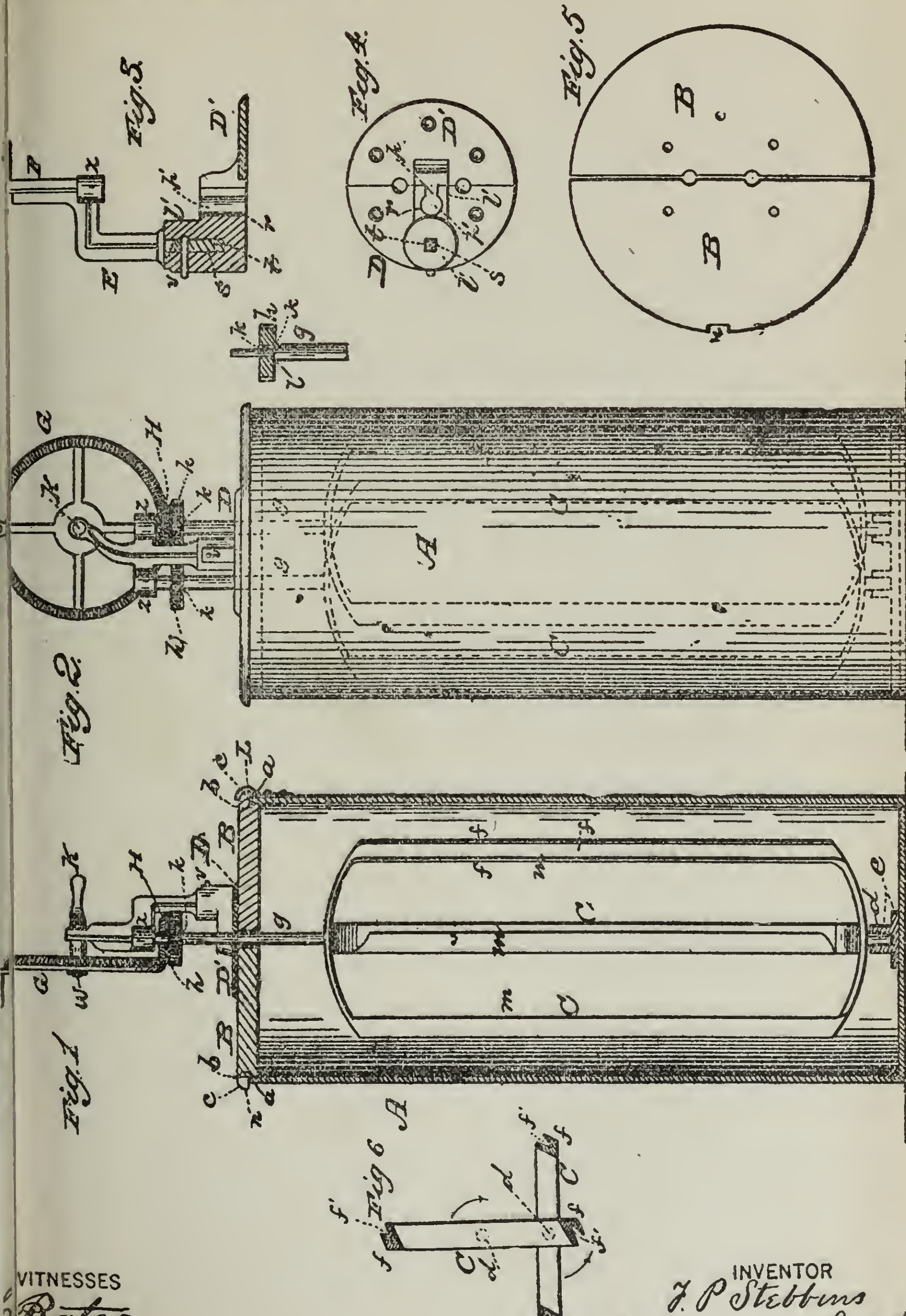
F. P. STEBBINS.

CHURN.

5053

No. 266,219. Patented Oct. 17, 1882.

Defendant's Exhibit No. 48.



WITNESSES

Bates,

[illegible]

INVENTOR

F. P. Stebbins

by Anderson & Smith

his [illegible]

United States Patent Office.

FRANK P. STEBBINS, OF DETROIT, MICHIGAN.

CHURN.

SPECIFICATION forming part of Letters Patent No. 266,219, dated October 17, 188

Application filed May 13, 1882. (No model.)

To all whom it may concern:

Be it known that I, FRANK P. STEBBINS, a citizen of the United States, and a resident of Detroit, in the county of Wayne and State of Michigan, have invented a new and valuable Improvement in Churns; and I do hereby declare that the following is a full, clear, and exact description of the construction and operation of the same, reference being had to the annexed drawings, making a part of this specification, and to the letters and figures of reference marked thereon.

Figure 1 of the drawings is a representation of a vertical sectional view of my churn and freezer. Fig. 2 is a side view of the same, and Figs. 3, 4, 5, and 6 are detail views.

This invention has relation to churns and cream-freezers; and it consists in the construction and novel arrangement of the studded catches for the lid-sections, the separable arm or support for the drive-wheel, and its double bearing for the upper ends of the dasher-stems, the plate-sections for the lid-sections, and the socket-and-tongue connection with which they are provided, all as hereinafter set forth.

In the accompanying drawings, the letter A designates the case, which is of ordinary upright form, having a circular area in horizontal section.

B B indicate the cover-sections, each being semicircular and marginally rabbeted at *a* to form a lip, *b*, which fits within the mouth of the case, and a marginal rim-flange, *c*, which projects outward over the edge of the case.

C C represent the dashers, which are made in loop form, being cast of metal. The lower end of each loop-dasher is formed with a supporting-stem, *d*, which works in a pivot-bearing, *e*, at the bottom of the case. The upper end of each loop-dasher is formed with a vertical stem, *g*, which extends upward through a bearing at the joint of the cover-sections, and is provided with a pinion, *h*, as indicated in the drawings. The pinion is secured on the stem by means of a spline, *k*, which is cast on the stem, so that, while it is fast thereto for all purposes of communicating rotary motion, it can be easily and quickly removed. Each stem is cast with a shoulder, *l*, below the spline, on which the pinion rests. The side bars, *m*, of each loop-dasher are cast with oblique longitudinal flanges *f* on their outer edges, flanges being turned in opposite directio the side bars; so that the V-form channe which lie between the flanges and the bars, will face or open in opposite direct as shown. The object of these channels aerate the milk or cream as the loops turned. The stems of these dashers are pl sufficiently close together to allow each in its rotary movement, to intersect the of the other without interference.

D D′ represent the semicircular plate tions, which are respectively secured to upper surfaces of the cover-sections at middle and adjacent portions, so as to when closed together, an iron bearing w is concentric with the periphery of the c The plate D′ is formed with a lug at its carrying a projection, *p*, which extends a the joint of the meeting edges of the tw tions, and is enlarged at its outer end, as cated at *p′*, forming a coupling-tongue t gage a slotted socket-recess, *r*, of corres ing form, which is made in a large lug, *l′* on the top of the other plate-section, D. lug *l′* is also formed with a square sock extending downward into its upper po which is designed to receive the squared t of the double bearing-arm E. A pin, *v*, ing through registering-perforations i socket *s* and tang *t*, serves to secure th in its seat in such a manner that, whil perfectly secure; it can be easily removed. arm E is formed with two lateral bearing in which the upper ends or journals c stems *g* of the dashers are seated, and an upward and lateral extension, F, car a transverse bearing, *w*, for the driving wheel G, which engages a bevel-pinion, the stem *g*, over which the laterally-p bearing *w* is situated, as indicated in the ings.

K represents a transverse handle on t tension F, in rear of the bearing *w*, wh designed to enable the operator to stea machine with one hand while turning th dle of the drive-wheel with the other. construction is designed to form a stro compact support for the gearing and d stems, whereby the driving mechanism is tained in proper position when the cov e in place and duly connected by the and socket of their iron plates, and F is fastened in its seat, and it per- e ready removal of the driving mech- when the case is to be opened. In this on the pin v is drawn out of the socket he arm E, with the drive-wheel, is lifted id socket. The pinions can then be re- from the dasher-stems, if necessary.

der to secure the cover firmly to the ll, the latter is provided with the edge- , which are fastened by studs or rivets wall, and, projecting by their heads he same, serve to engage the rim-flanges cover-sections, one of which is formed edge-notch, n, to facilitate the engage- it.

ng described this invention, what I nd desire to secure by Letters Patent,

e cover-plates D D′, having a tongue- ket connection, and a separable arm, he drive-wheel, carrying a double bearing for the upper ends of the stems of the dashers, substantially as specified.

2. The cover-sections having the plate-sections D D′, connected by tongue p' and socket r, and the edge-hooks L of the wall engagin.. the rim-flanges c of the cover-sections, s.. stantially as specified.

3. The combination, with the dashers C, having the splined and shouldered st as g, and their pinions h H and the drive-wheel G, of the cover-sections B, plate-sections D D′, their socket-and-tongue connection, the socket s, pin v, and removable arm E, having the lateral bearings z, and the extension F, substantially as specified.

In testimony that I claim the above I have hereunto subscribed my name in the presence of two witnesses.

FRANK PIERCE STEBBINS.

Witnesses:
LOUIS F. GUENTHER,
ADAM E. BLOODE.

GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Defendant's Exhibit No. 49.

(No Model.)

2 Sheets—Sheet

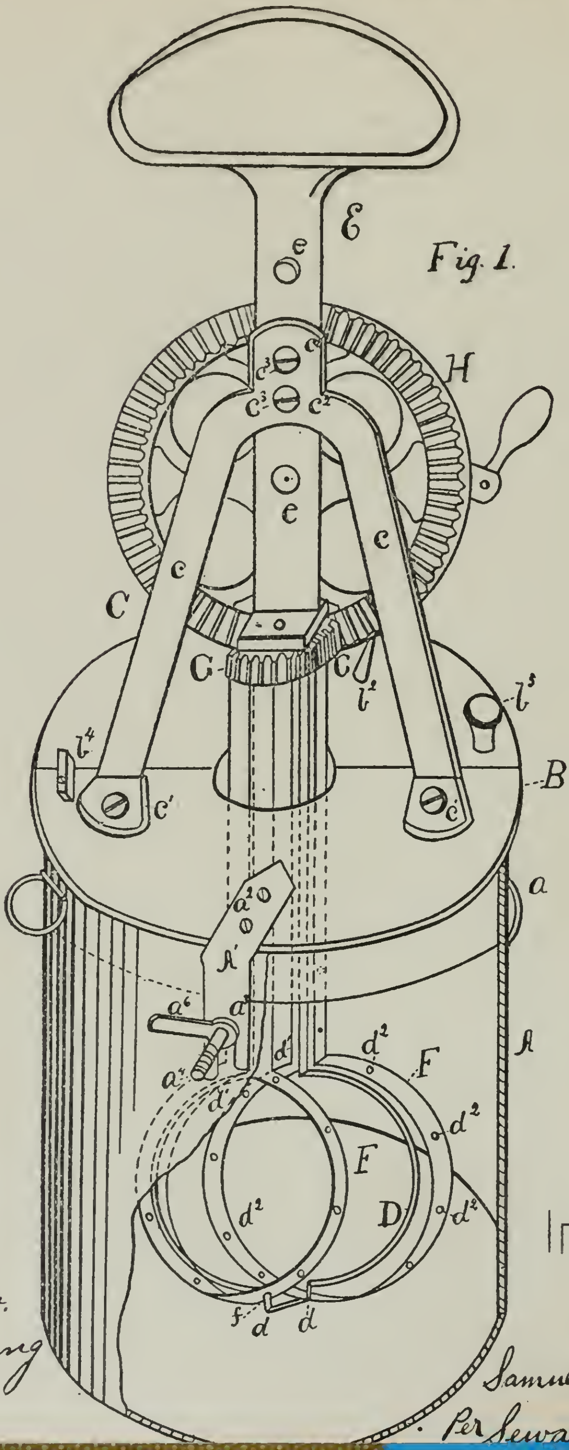
S. J. SULLIVAN

CHURN.

No. 306,441.

Patented Oct. 14, 1884.

Fig. 1.



Witnesses.

G A Haseltine

Henry C Young

Inventor

Samuel J. Sulli

Per Seward A. Haz

(No Model.) 5057

S. J. SULLIVAN.

CHURN. 2 Sheets—Sheet 2

No. 306,441. Patented Oct. 14, 1884.

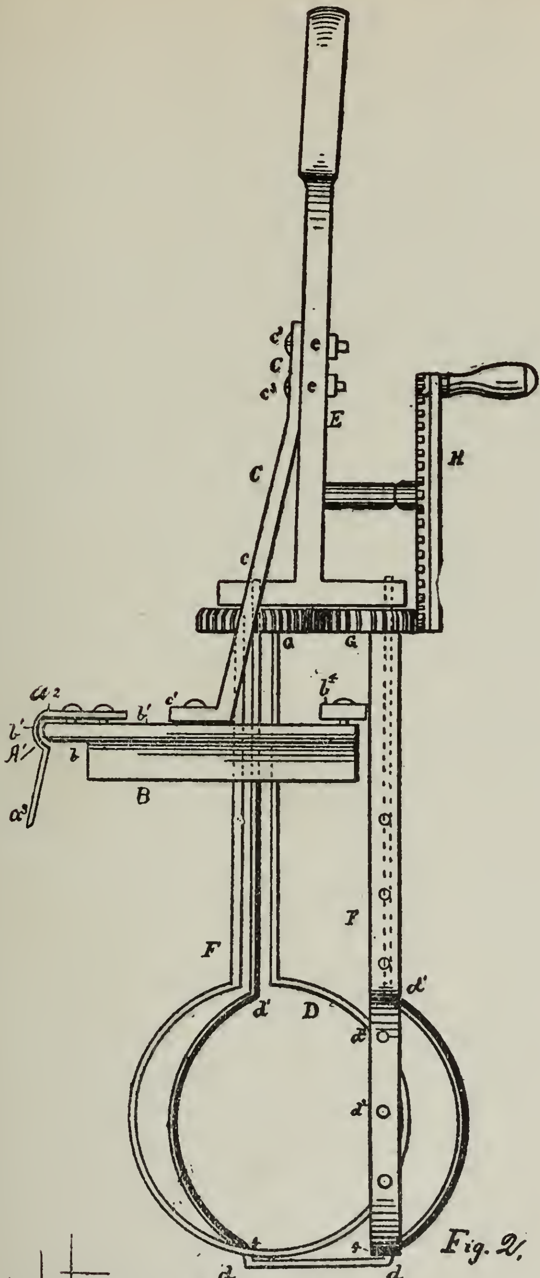


Fig. 2.

Witnesses.

G. A. Haseltine.
N. A. Haseltine

Inventor

Samuel J. Sullivan
By Seward A. Haseltine.
Attorney

UNITED STATES PATENT OFFICE.

SAMUEL J. SULLIVAN, OF LAMAR, MISSOURI.

CHURN

SPECIFICATION forming part of Letters Patent No. 306,441, dated October 14, 1884

Application filed October 29, 1883. (No model.)

To all whom it may concern:

Be it known that I, SAMUEL J. SULLIVAN, a citizen of the United States, residing at Lamar, in the county of Barton and State of Missouri, have invented certain new and useful Improvements in Churns, of which the following is a specification, reference being had therein to the accompanying drawings.

My invention relates to improvements in churns, the object of which is to provide an easy, convenient, and rapid means of churning and obtaining butter from cream, and also to provide a churn that is easily cleaned, and one simple in its construction and operation, and adapted to be used in earthen or other vessels. I attain these objects by means of the device illustrated in the accompanying drawings, forming a part of this specification, in which—

Figure 1 is a view in elevation showing the entire device, a part of the vessel being removed. Fig. 2 is a view showing the parallel dashers and adjustable support.

Similar letters of reference indicate corresponding parts in all the figures.

A is a vessel made of wood, tin, stone, earthen or other suitable material and of any convenient size and shape, preferably made of wood, cylindrical in shape, and with suitable ears or handles, *a a*, for moving the churn.

B is a thick cover, preferably made of wood with a groove or rabbet, *b*, to fit closely in the top of the vessel A, the flange b' being projected over the edges. The cover is made with a hole in the center, and it is divided in two parts to facilitate its removal and the better to clean the dashers passing through it.

b^2 is a hook or latch, to hold the cover firmly to its place. The latch or latches may be upon either one or both sides.

In using an earthen vessel, I put a strap or band, b^3, around the top, to which the hooks are attached. On wood or metal vessels I use an attachment, A', consisting of a piece, a^2, firmly attached to the cover and extending over the flange, thence down, forming a fork, a^3, which passes on each side of a bolt, a^4, the said bolt being firmly attached to or through the vessel, and having a nut, a^6, with a thumb-piece for tightening the same, and thus firmly holding the supporting part of the cover to its position.

b^4 is a button to swing across the place where the cover divides.

b^5 is a knob used in raising one part of the cover.

C is a support having two spreading braces *c c*, both attached to one and the same part of the cover by foot-pieces $c' c'$, and an upper portion made with holes $c^2 c^2$, in which are placed thumb-screws or set-screws $c^3 c^3$, to firmly hold and adjust the dashers.

The dashers F F are constructed and operated somewhat similar to the common egg-beater, which I change and modify for use in connection with the novel devices above explained, for the objects hereinafter more fully set forth.

The dashers are constructed and placed in the vessel as follows: A strong metallic rod, D, is bent each side of and near the middle so as to form two right angles, *d d*, for bearings for the dashers. The ends are then turned upward and inward until they form nearly a complete circle, and at points $d' d'$, opposite the points *d d*, the ends are bent vertically and parallel until they reach up through the cover and terminate in a handle, E. The dashers are made of thin perforated metal, and bent in similar form as the rod D, and have their upper ends attached in pinions G G. Holes are made in the middle of the lower part of each dasher, through which one end of the supporting-rod D passes until the bearings of the dashers are formed at *d d*. The pinions G G have bearings on the upper part of the rod D, and are operated by a gear-wheel, H. The gear-wheel has bearings on an arm of the handle E, and operates directly upon one of the pinion-wheels which operates upon the other. Thus geared, the dashers turn in opposite directions, and the circular part of each dasher being constructed so as nearly to fill the diameter of the vessel in which it is to be used and to intersect each others tracks without interference, I make the parallel parts of each dasher close together, so that the air is sucked down between them by the rapid rotary mo-f the circular part and thus the entire isaerated. This process of distributing rough the cream is assisted by the per- ons d', by which I have obtained butter minutes, and herein is one of the great tages of my invention. In the handle ake holes e e e for attaching it to the sup- , the rod D being attached to the han- When the handle is raised, one-half of ver and everything in the vessel may be ed, thus leaving it easy to wash the ves- t having holes or cleats in the bottom to it difficult to clean as heretofore in ro- ash-churns, and herein is another ad- e of my invention. The circular part dashers I place beneath the cream by of the thumb-screws on the support C, enter the holes e e, thus permitting the ed dashers to be raised or lowered, as l. This permits the parallel parts of shers to enter the surface and thus pre- l splashing and throwing of the cream churning, and herein is another great age of the parallel and adjustable con- on of my invention.

Having thus described the use, construction, and operation of my invention, I am aware that it is not new to provide a churn with rotary dashers, or to have such dashers perforated, or to have the lower parts made rounding and propelled by gear-wheels. I do not, therefore, claim such construction broadly; but

What I claim as new, and desire to secure by Letters Patent, is—

The combination of a vessel, A, severable cover B, slotted attachment A', support C, secured to one side of the said cover, adjustable handle E, rod D, drive-wheel H, pinions G G, and perforated rotary dashers F F, having circular bottoms and rods placed parallel and close together the better to agitate and force air into the cream, substantially as shown and described, for the purpose set forth.

In testimony whereof I affix my signature in presence of two witnesses.

SAMUEL J. SULLIVAN.

Witnesses:

JOSEPH S. MCBRIDE,
J. P. FROW.

y 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Defendant's Exhibit No. 50.

Die trocknenden Oele

ihre

Eigenschaften, Zusammensetzung und Veränderungen

sowie

Fabrikation der Firnisse aus denselben zu Anstrichen und für Buchdrucker, genaue Darstellung der Fabrikation aller Anstrich-, Buchdruck-, Stein- und Kupferdruckfarben.

Ein Handbuch

für

Lack-, Firniß- und Farbenfabrikanten, Kaufleute, Anstreicher, Lackirer, Maler u. s. w.,

nach dem

neuesten Stande dieser Industriezweige, unter Benutzung der hervorragendsten Literatur und nach eigenen vieljährigen Erfahrungen dargestellt

von

Louis Edgar Andés,

Lack- und Firniß-Fabrikant in Wien

Mit 49 in den Text eingedruckten Holzstichen

Braunschweig,

Druck und Verlag von Friedrich Vieweg und Sohn

1882.

Reinigung.

steht auf dem oberen Boden und enthält zwei durchbohrte Böden, durch welche es in drei Abtheilungen zerlegt ist. Die untere derselben steht durch ein kurzes knieförmig gebogenes Rohr mit dem Oelbehälter in Verbindung, während die mittlere mit gröblich gepulverter Kohle, Baumwolle, Filz u. dergl. gefüllt wird. Die obere Abtheilung dient zum Ansammeln des filtrirten Oeles und ist mit einem Hahne zum Abziehen desselben versehen. Fig. 5 zeigt die Einrichtung. Sind die Cisterne mit Wasser und der Behälter mit Oel gefüllt, so öffnet man die Röhre; das Wasser tritt nun in den Oelbehälter und nimmt in demselben in Folge seiner Schwere den unteren Raum ein, während das Oel durch die eine Röhre in das Filter steigt und durch den hydrostatischen Druck der in der anderen Röhre enthaltenen Wassersäule durch das Filter getrieben wird. Wenn sich nach fortgesetzter Arbeit in dem unteren Raum des Filters ein schleimiger Absatz aus dem Oele sammelt, so läßt man diesen durch den Hahn ab. Man hat es auf diese Weise in seiner Gewalt, das klare Oel schnell von dem Bodensatze zu trennen.

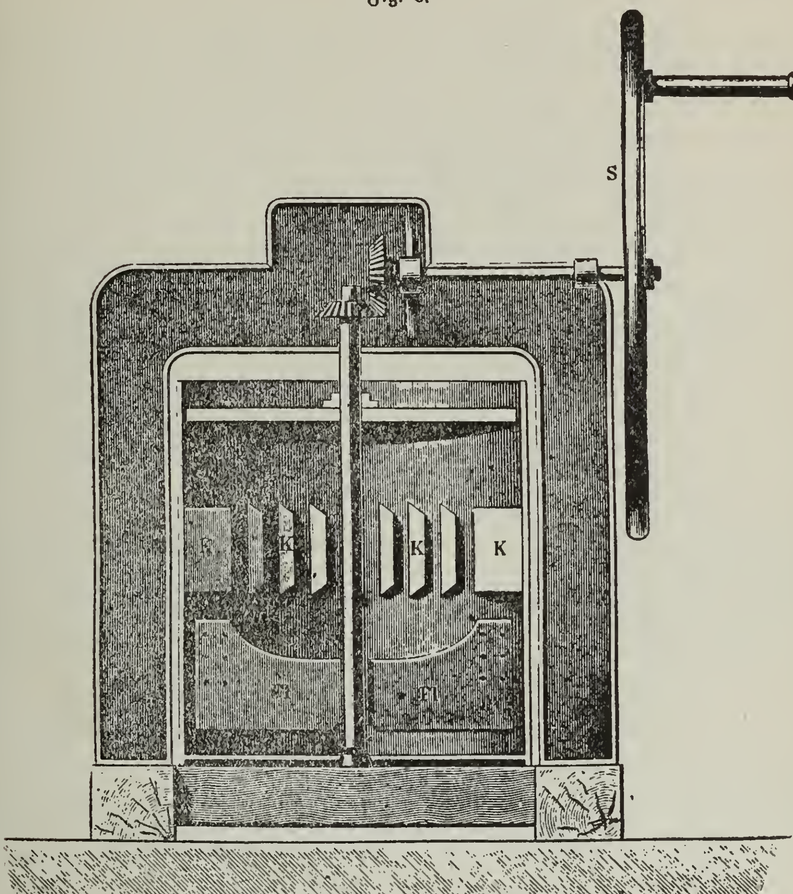
Ein anderes Verfahren ist folgendes: Man bringt das zu reinigende Oel in eine, einem Drehbutterfasse gleichende Tonne, in deren Innerem sich eine mit Flügeln versehene Welle befindet, die durch eine Kurbel in Bewegung gebracht wird. Zu dem Oele gießt man das zweifache Volum reines Flußwasser, in dem etwas Kochsalz aufgelöst wurde. Nachdem die Tonne geschlossen worden, bringt man die Mischung eine volle Stunde lang durch Umdrehen der Welle in Bewegung. Je schneller dieses Umdrehen geschieht, um so mehr wird für die Reinigung des Oeles gesorgt. Man öffnet nun die Tonne und gießt das Ganze in einen Kübel, an dessen Seite ein Hahn in solcher Höhe angebracht ist, daß das nach einiger Ruhe über das Wasser tretende Oel rein durch denselben abgelassen werden kann. Nachdem man das Oel nun 24 Stunden der Ruhe überlassen hat, wird das Oel abgelassen und wieder in die Tonne gebracht, um mit ebensoviel Wasser als vorher abermals durcheinander geschlagen zu werden. In dem in dem Kübel zurückgebliebenen Wasser findet man einen bedeutenden Bodensatz, der durch den von dem Oele getrennten sogenannten Schleim gebildet worden ist. In neuerer Zeit sucht man Oele zum Zwecke der Firnißfabrikation auch auf mechanischem Wege mittelst Maschinen zu reinigen; bei diesen wird das Oel in heftige Bewegung versetzt und mit der Luft in innige Berührung gebracht, damit sich die Unreinigkeiten leichter ausscheiden und dem Oele schon vor dem Kochen Sauerstoff zugeführt werde.

Die von der Actiengesellschaft für Maschinenbau und Eisenindustrie zu Varel an der Jahde im Großherzogthume Oldenburg neuerdings gebaute Kataractmaschine scheint dazu berufen, alle anderen Maschinen, welche man bis jetzt zur rascheren Reinigung des Oeles verwendete, zu verdrängen, und verdient dieselbe Eingang in alle Firniß- und Lackfabriken. Fig. 6 (a. f. S.) zeigt einen Vertikalschnitt durch die Maschine. Das zu reinigende Oel wird bis zu einer Marke in das eiserne cylindrische Faß gegeben. Beim Drehen am Schwungrade S wird der Flügel *Fl* in rasche Umdrehung versetzt; das Oel steigt in Folge der Wirkung der Centrifugalkraft an den Wänden des Fasses in die Höhe, wird durch die Klappen *KK* und einem darüber liegenden Ring abgelenkt und stürzt in der Mitte zusammen; das Oel macht also einen Kreislauf, und während dieses Kreislaufes findet ein so intensives Mischen und eine so heftige

Leinöl.

Bewegung und dabei eine so innige Berührung mit der atmosphärischen Luft statt, wie es durch keine andere Maschine und auf keine andere Weise erreicht werden kann. Deshalb eignet sich die Maschine auch so sehr gut zur Reinigung des Oeles

Fig. 6.



Kataractmaschine zur Oelreinigung.

und kann außerdem auch noch zum Mischen von Firniß oder Lack mit Farben benutzt werden.

Die genannte Actiengesellschaft baut die Kataractmaschinen von 20 bis 400 Liter Inhalt, und kostet eine solche von 100 bis 125 Liter Inhalt mit eisernem Faß und rotirendem Deckel sammt großem Schwungrade für Handbetrieb 250 Mark D. Rw. ab Varel. Größere Maschinen werden nur für Kraftbetrieb mit Riemenscheiben geliefert.

Ein großer Theil des im Handel vorkommenden Leinöles wird mit Schwefelsäure gereinigt und kennt man verschiedene Verfahrungsweisen.

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By H. H. WALKER, Deputy.

Defendant's Exhibit No. 51.

Defts Ex 51
a dm

(Title Page, "AGRICOLA DE RE METALLICA" (Hoover Translation) is as follows:)

GEORGIUS AGRICOLA

D E R E M E T A L L I C A

Translated from the First Latin Edition of 1556.
with
Biographical Introduction, Annotations and Appendices up
the Development of Mining Methods, Metallurgical
Processes, Geology, Mineralogy & Mining Law
from the earliest times to the 16th Century.

by

HERBERT CLARK HOOVER

A.B.Stanford University, Member American Institute of Mining Engineers, Mining and Metallurgical Society of America, Societe des Ingenieurs Civils de France, American Institute of Civil Engineers, Fellow Royal Geographical Society, etc. etc.

and

LOU HENRY HOOVER

A.B.Stanford University, Member American Association for the Advancement of Science, The National Geographical Society, Royal Scottish Geographical Society, etc. etc.

Published for the Translators by

THE MINING MAGAZINE

Salisbury House, London E.C.

1912.

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By H. H. WALKER, Depu

BOOK VIII

A—Water-wheel. B—Axle. C—Stamp. D—Hopper in the upper millstone. E—Opening passing through the centre. F—Lower millstone. G—Its round depression. H—Its outlet. I—Iron axle. K—Its crosspiece. L—Beam. M—Drum of rundles on the iron axle. N—Toothed drum of main axle. O—Tubs. P—The small planks. Q—Small upright axles. R—Enlarged part of one. S—Their paddles. T—Their drums which are made of rundles. V—Small horizontal axle set into the end of the main axle. X—Its toothed drums. Y—Three sluices. Z—Their small axles. AA—Spokes. BB—Paddles.

Defendant's Exhibit No. 52.

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By H. H. WALKER, Deputy.

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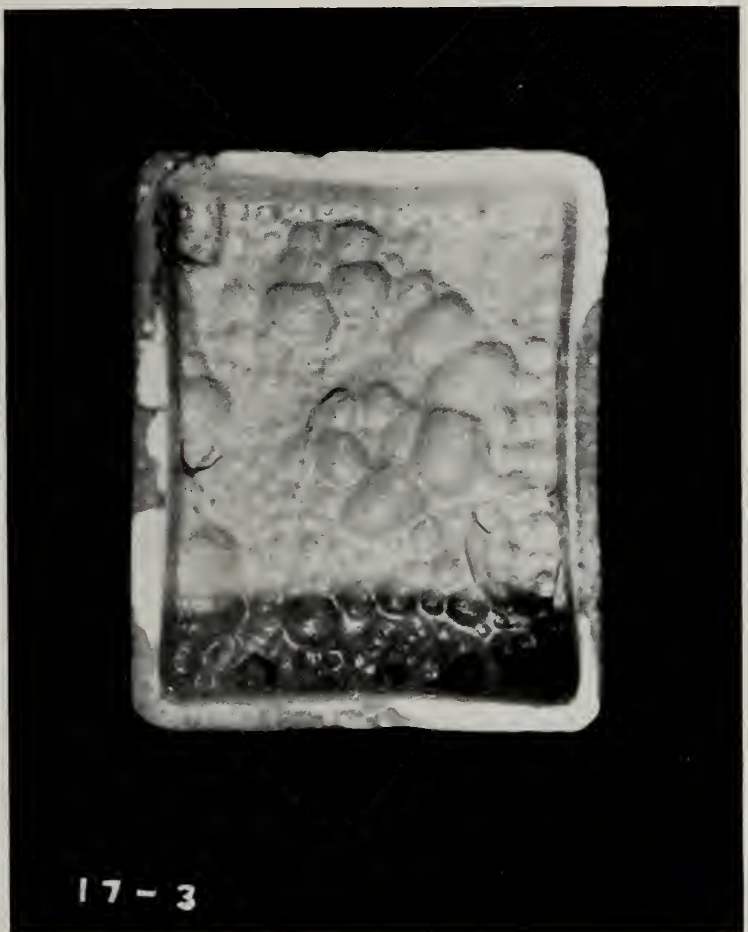

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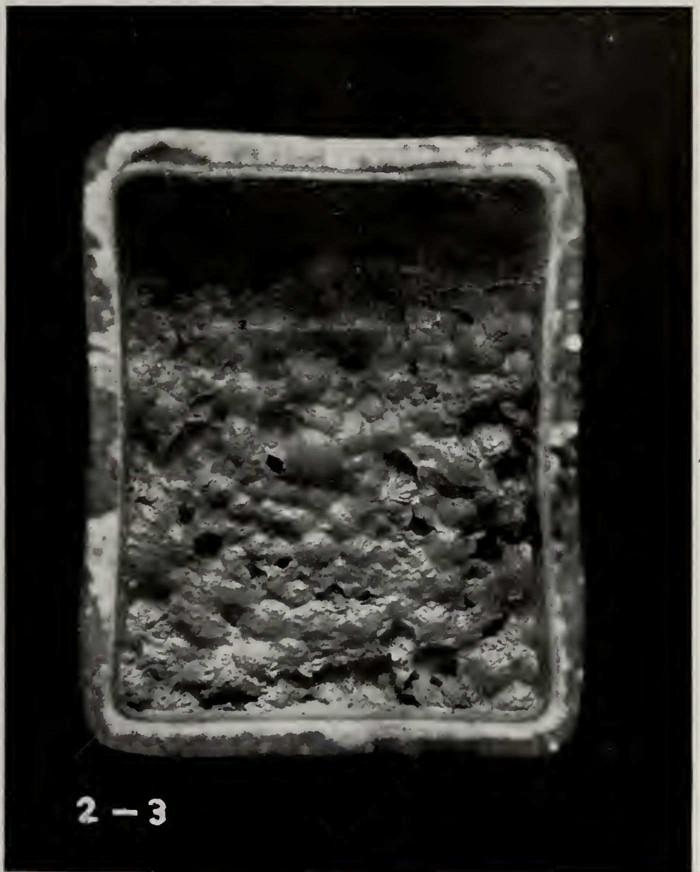

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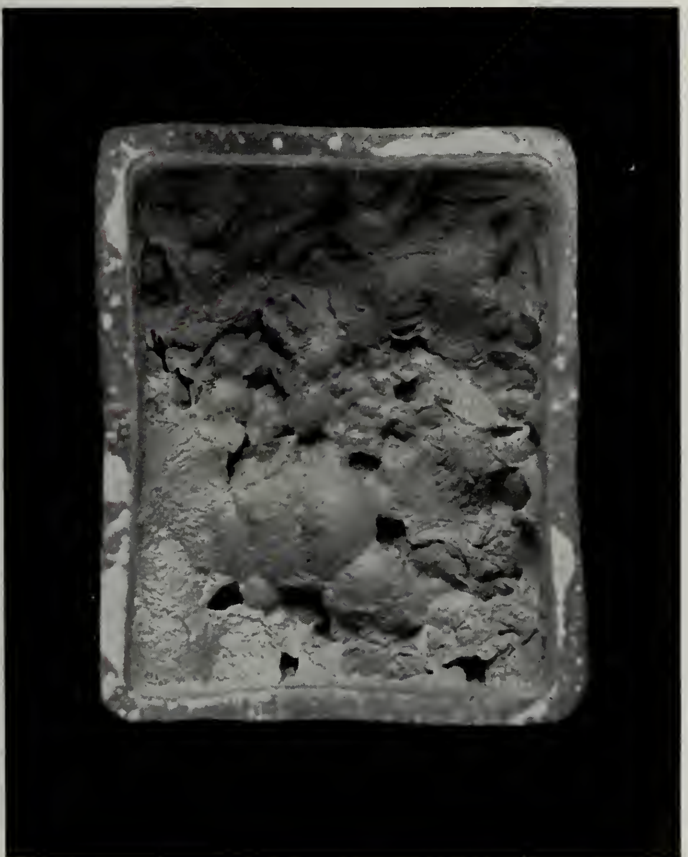

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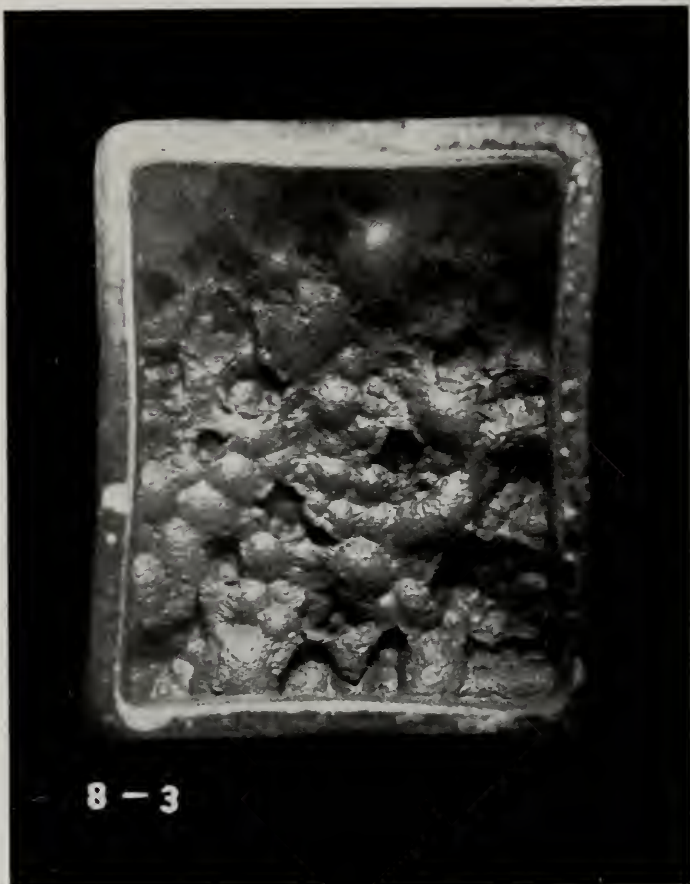

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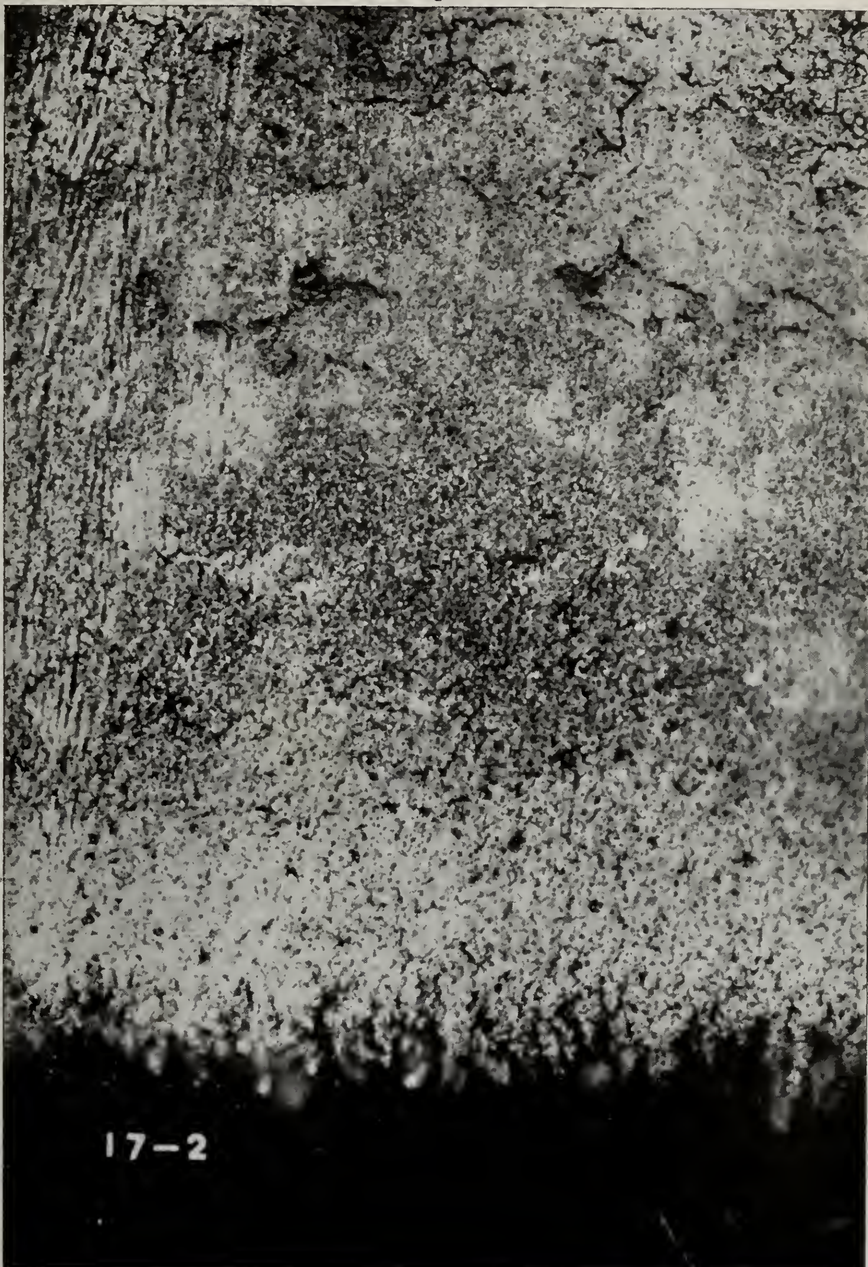

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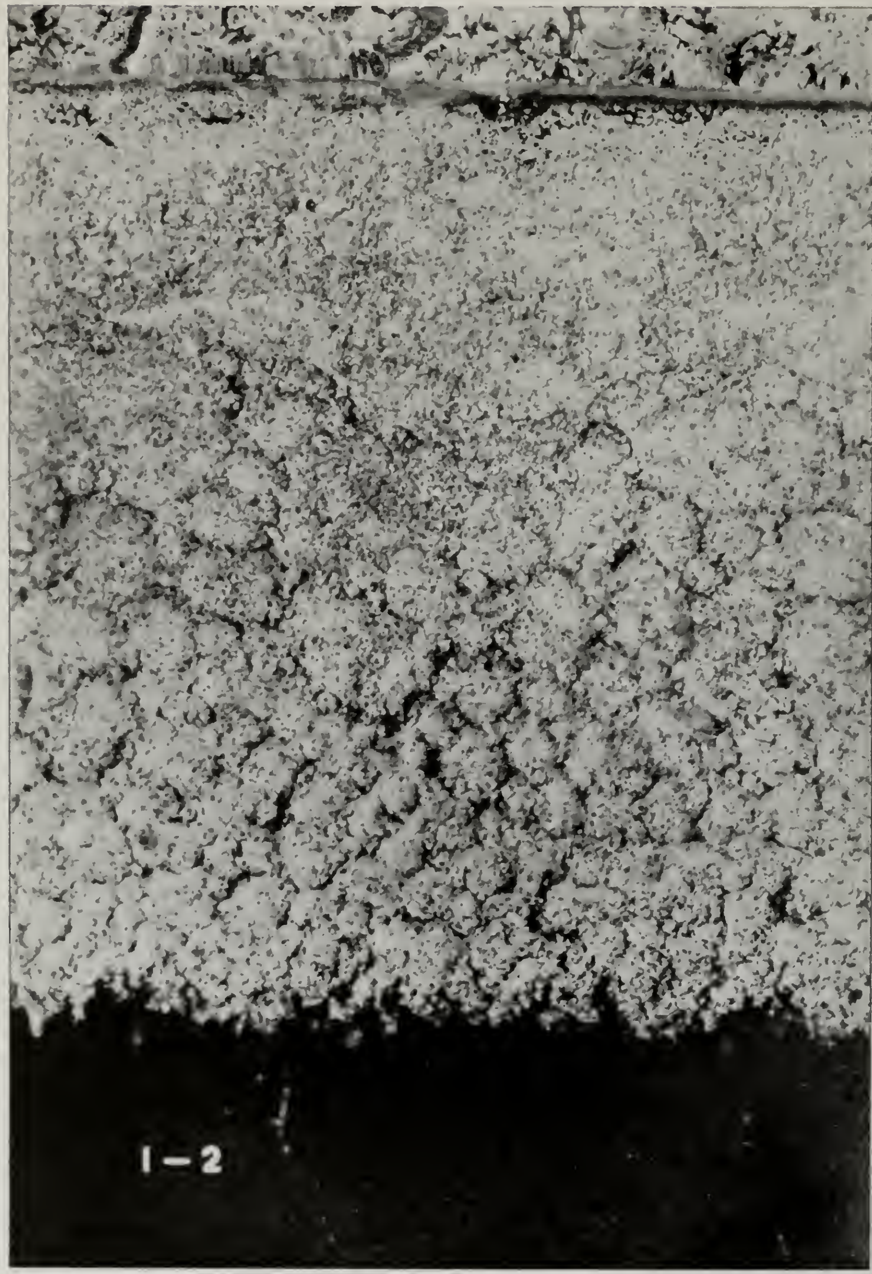

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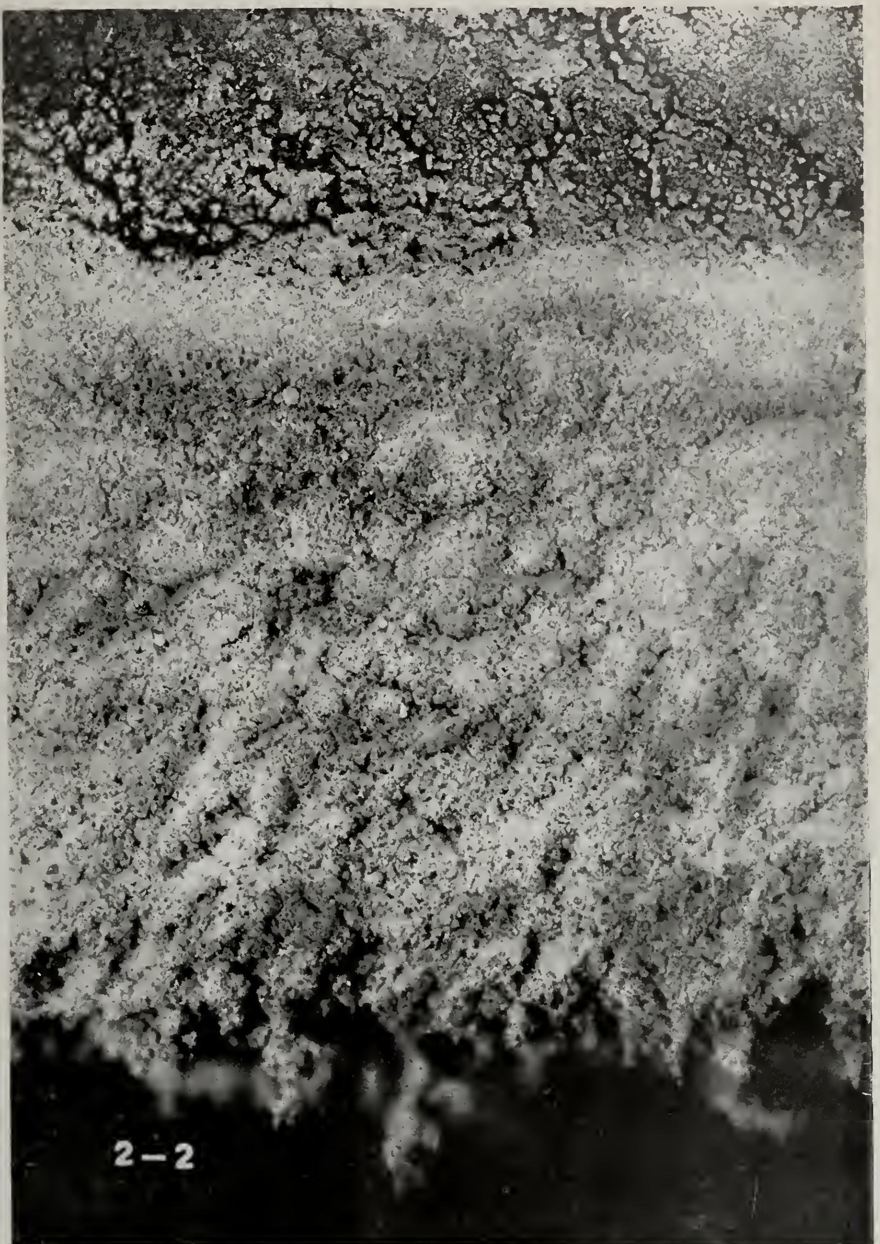

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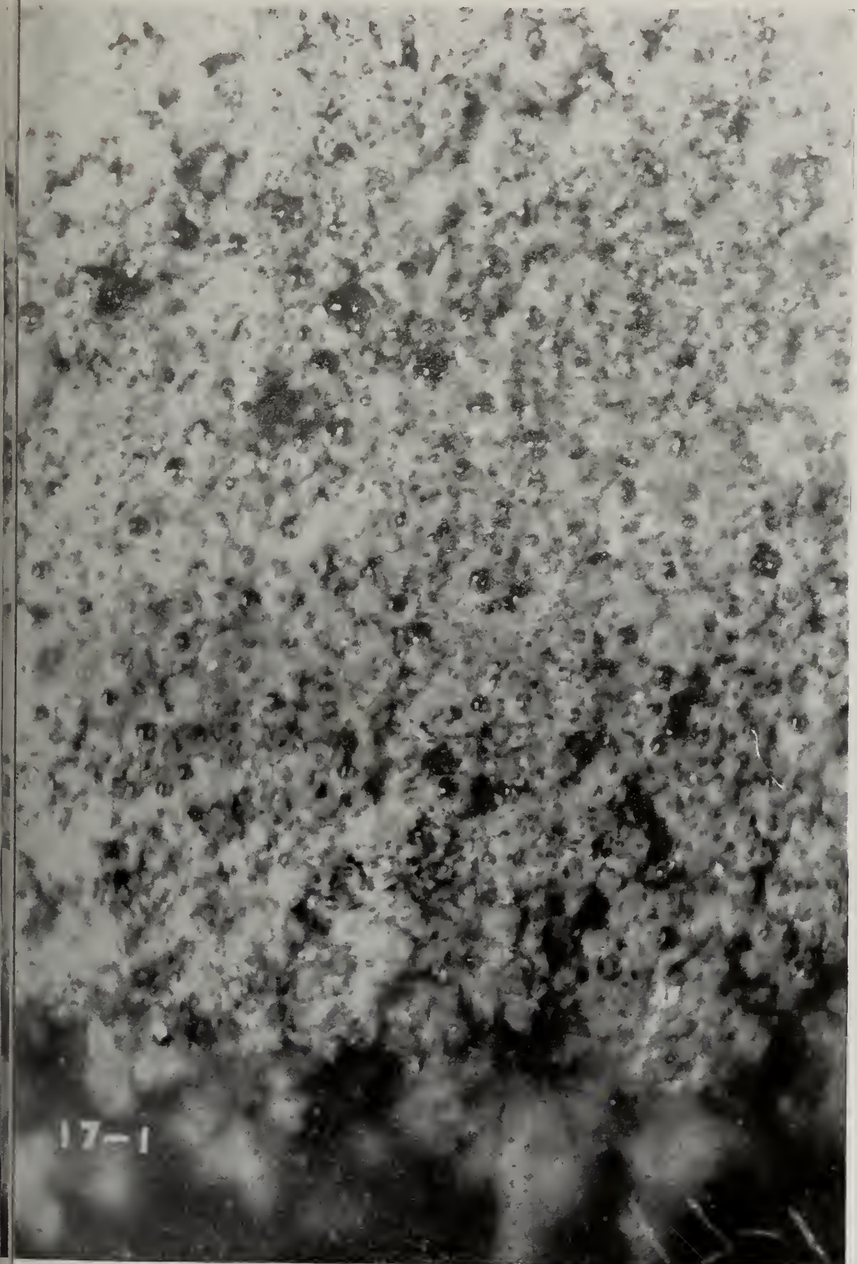

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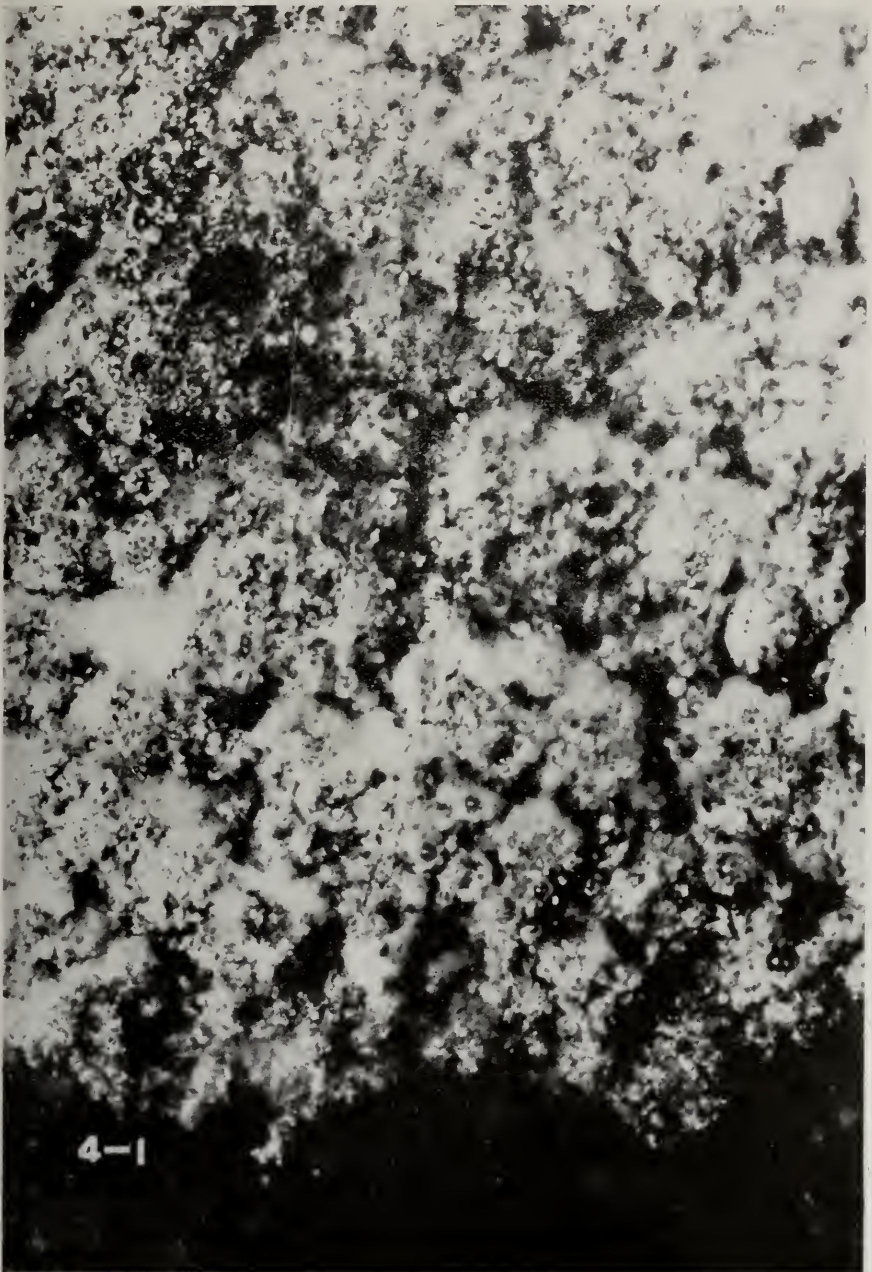

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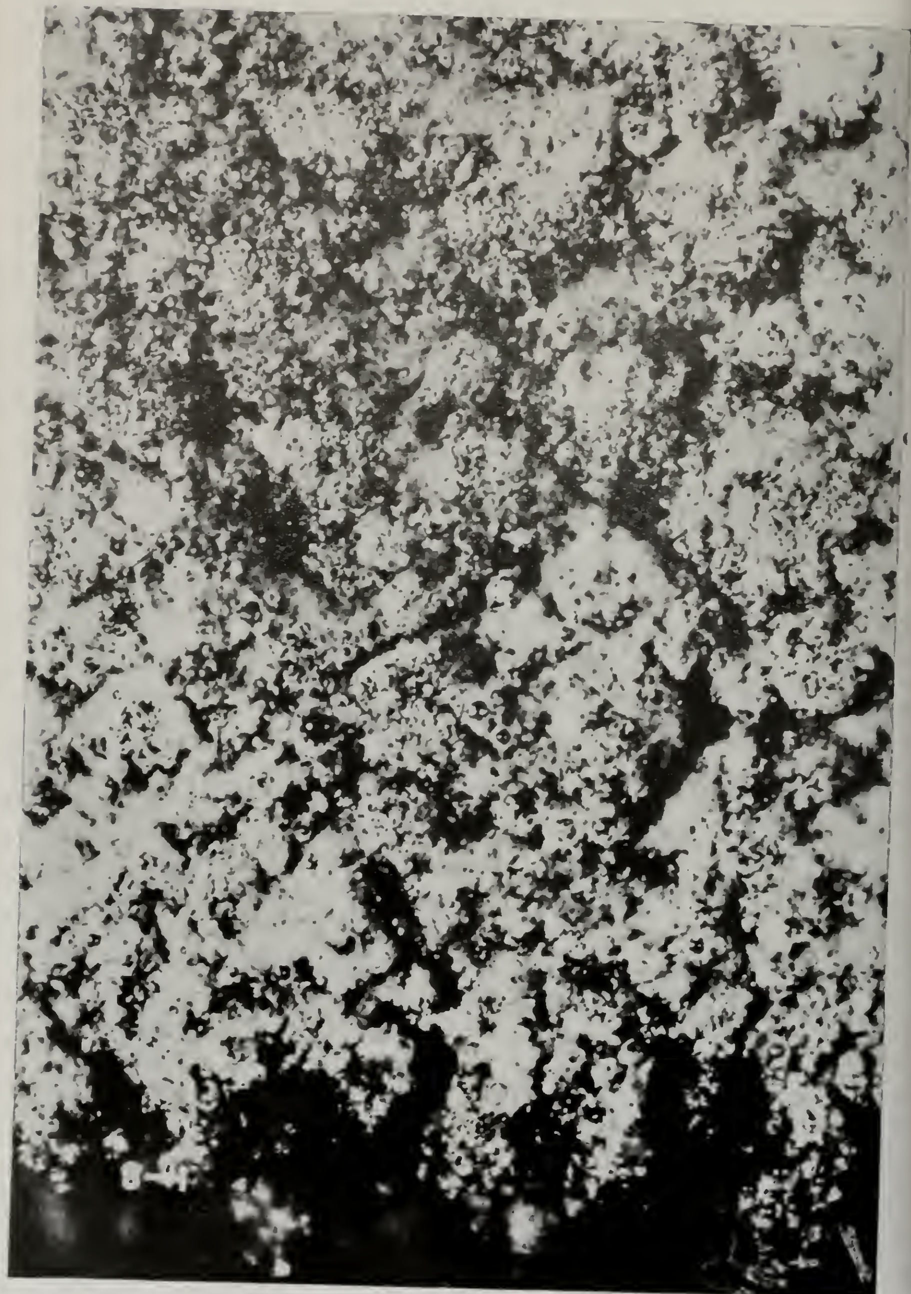

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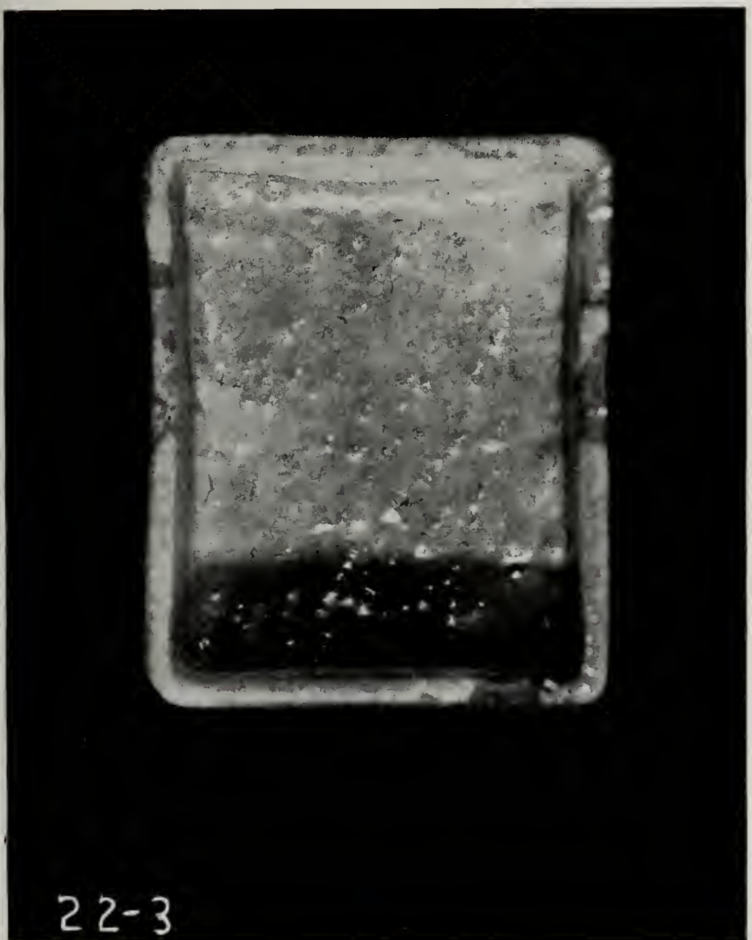

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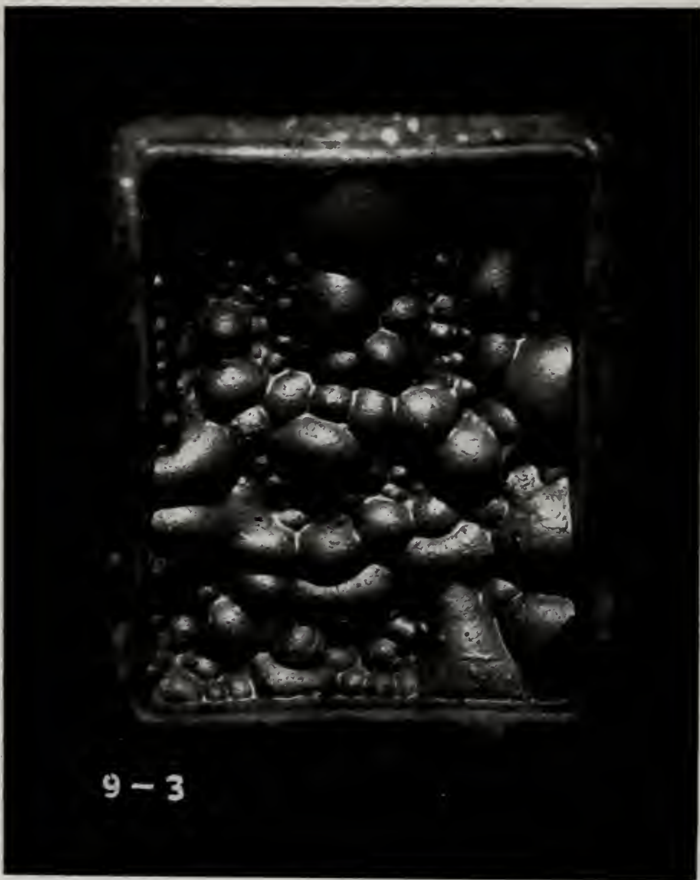

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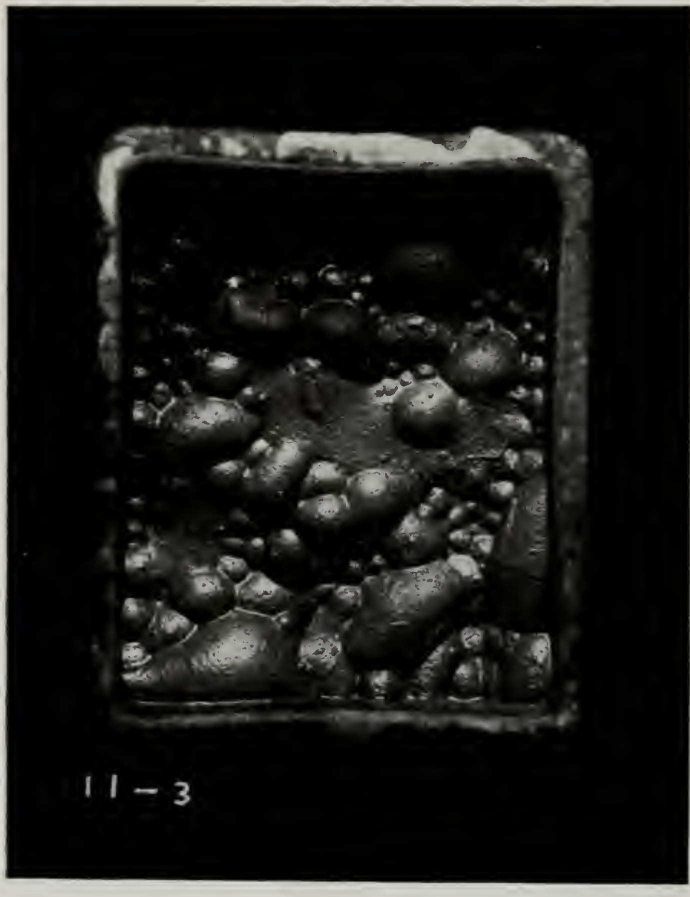

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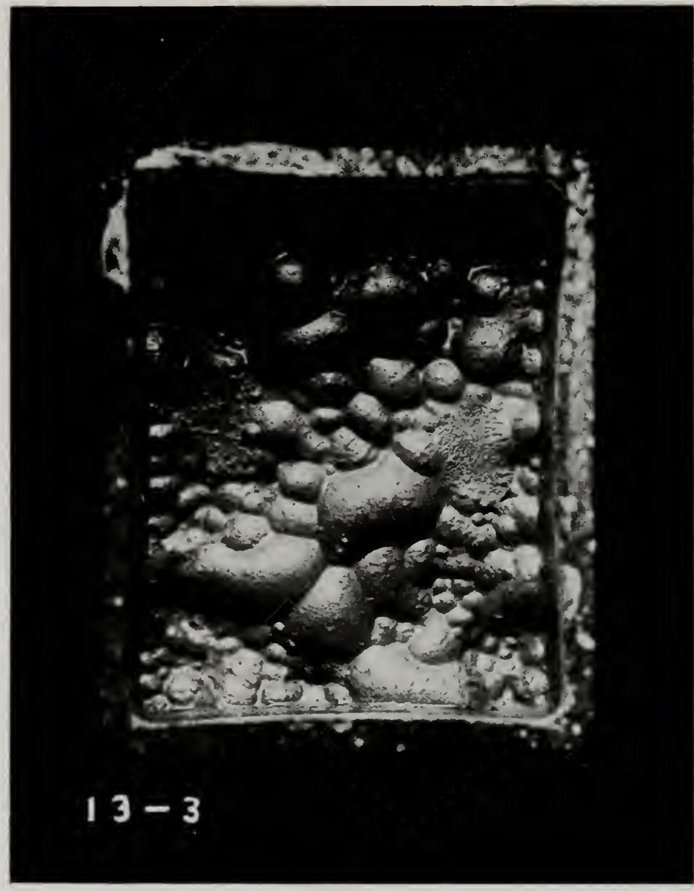

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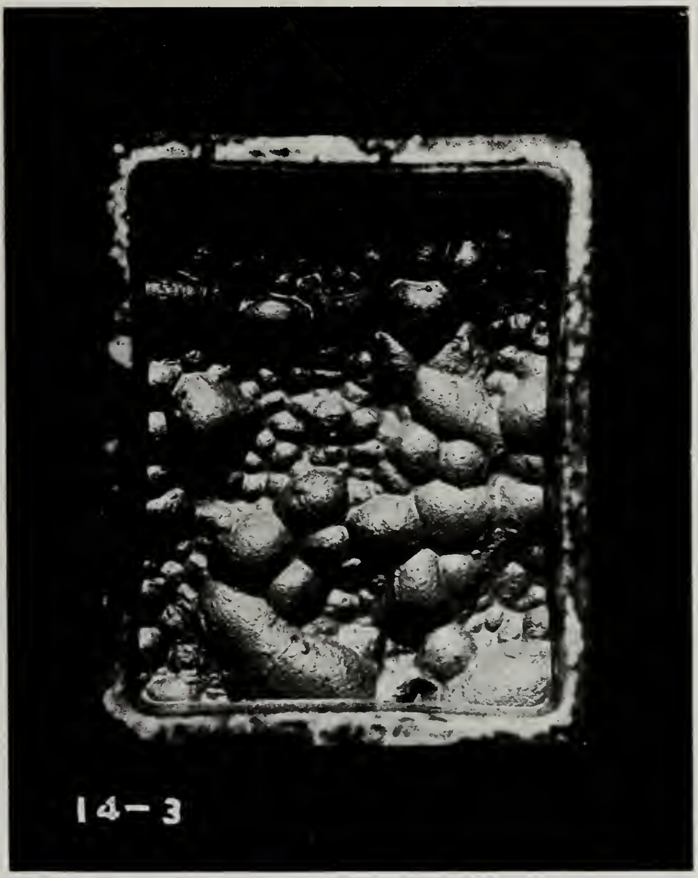

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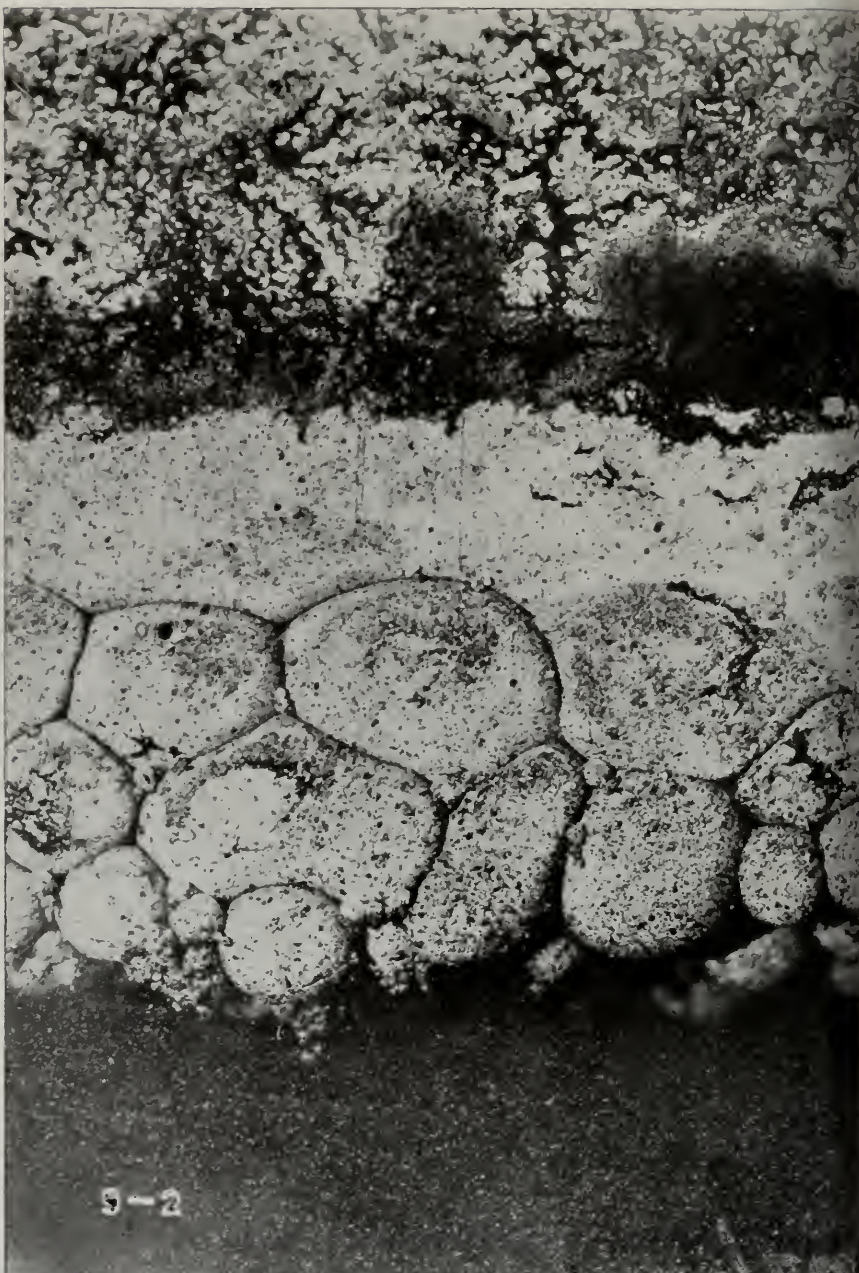

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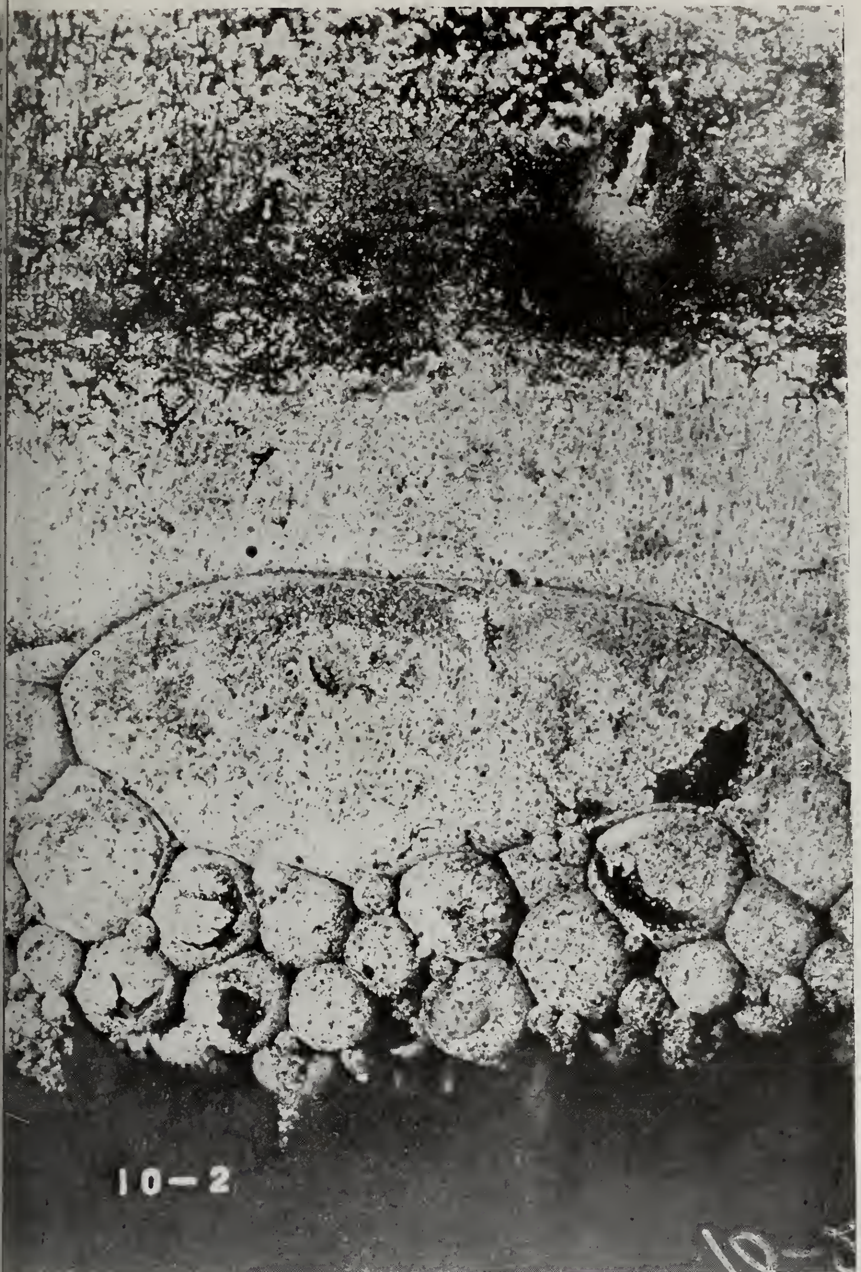

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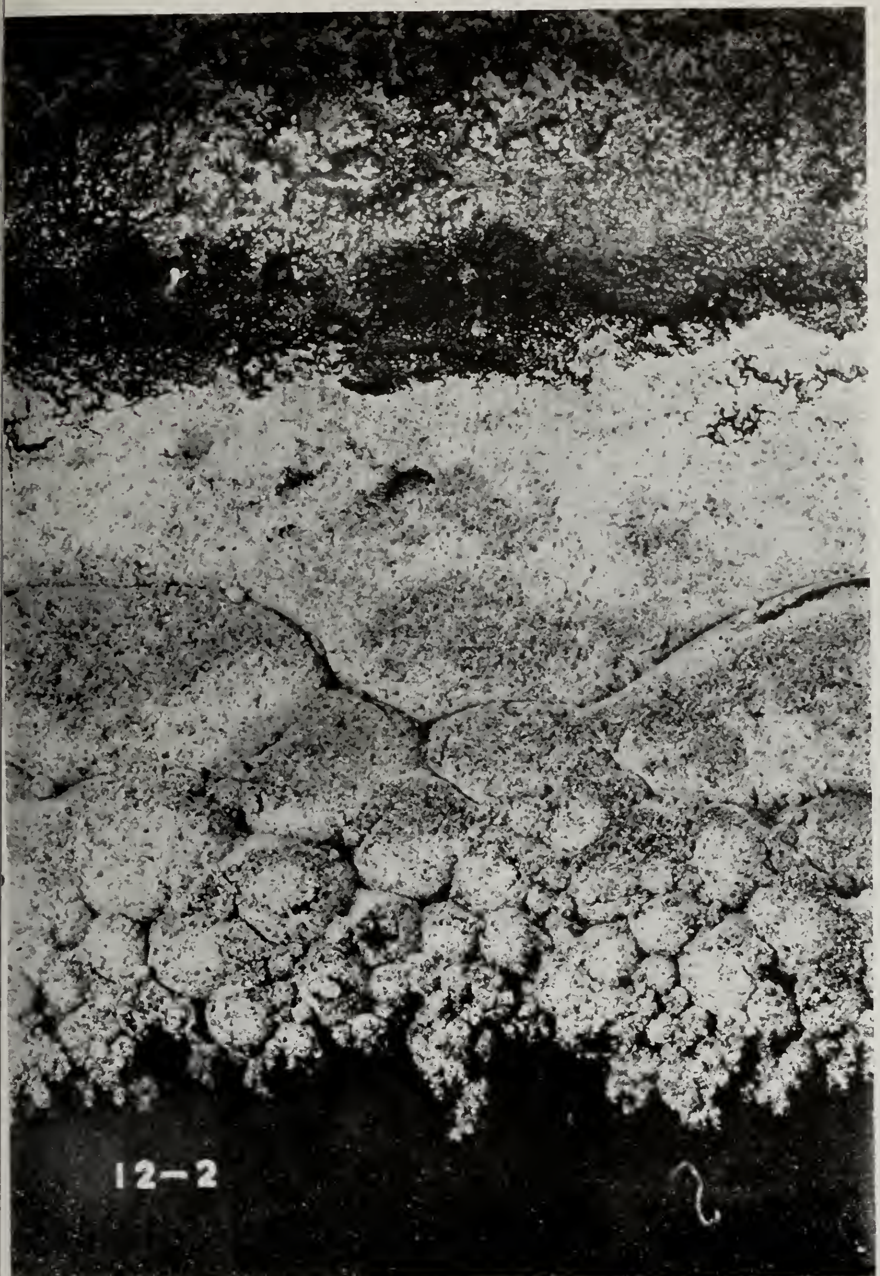

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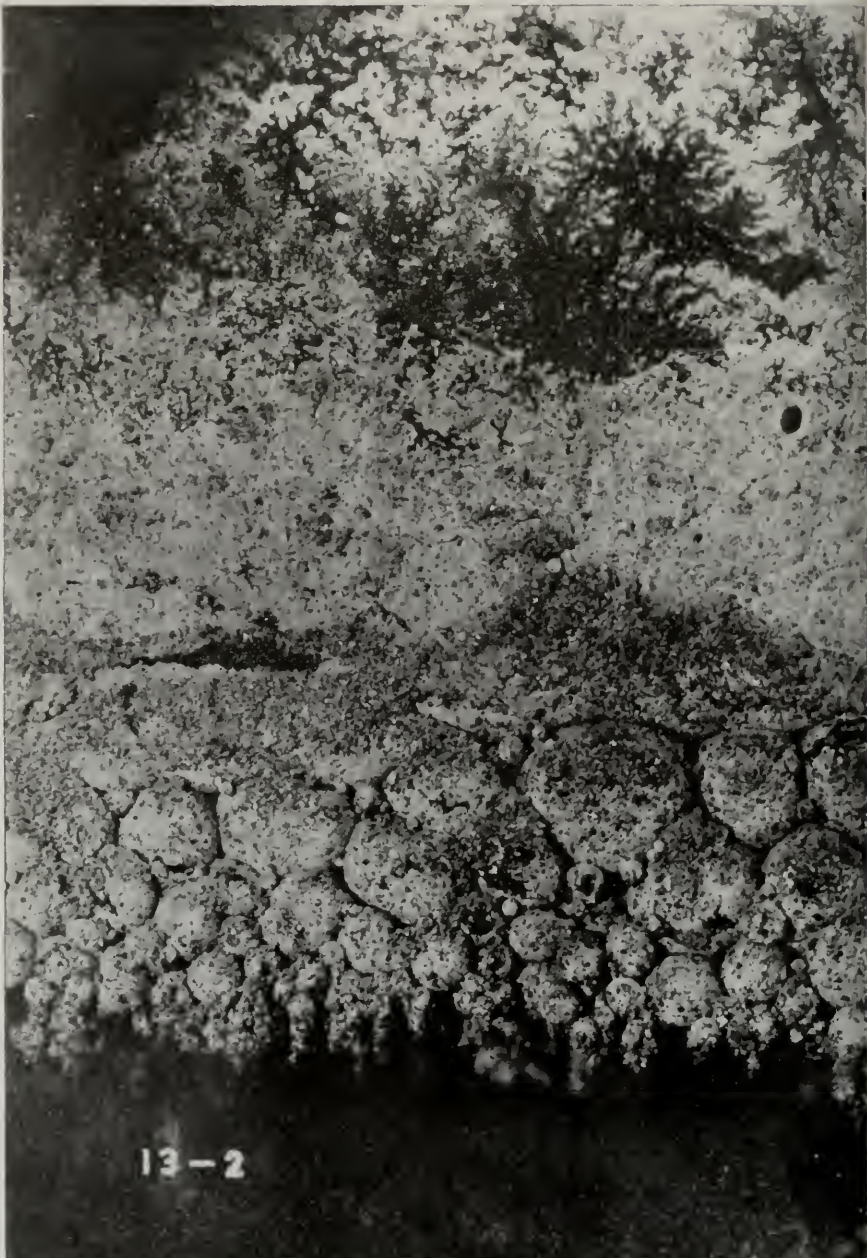

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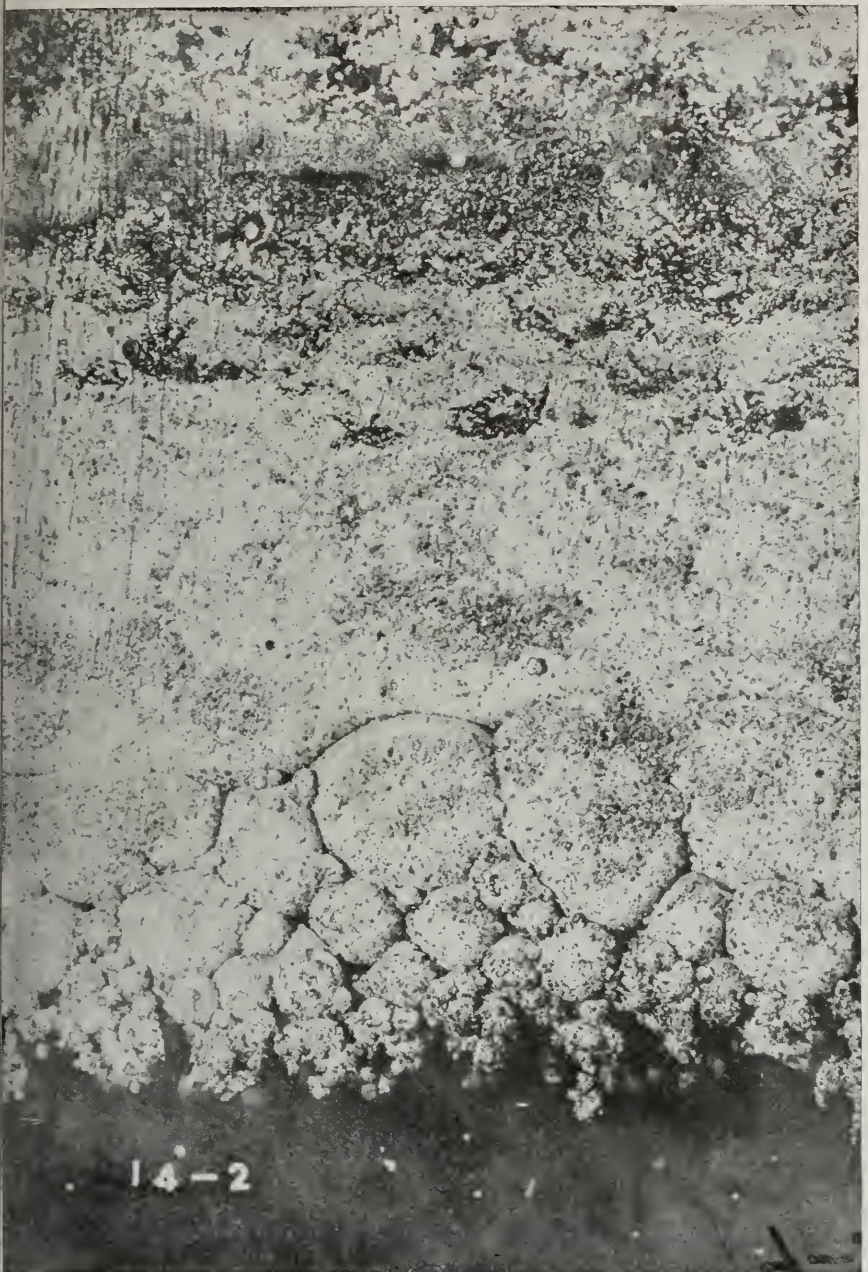

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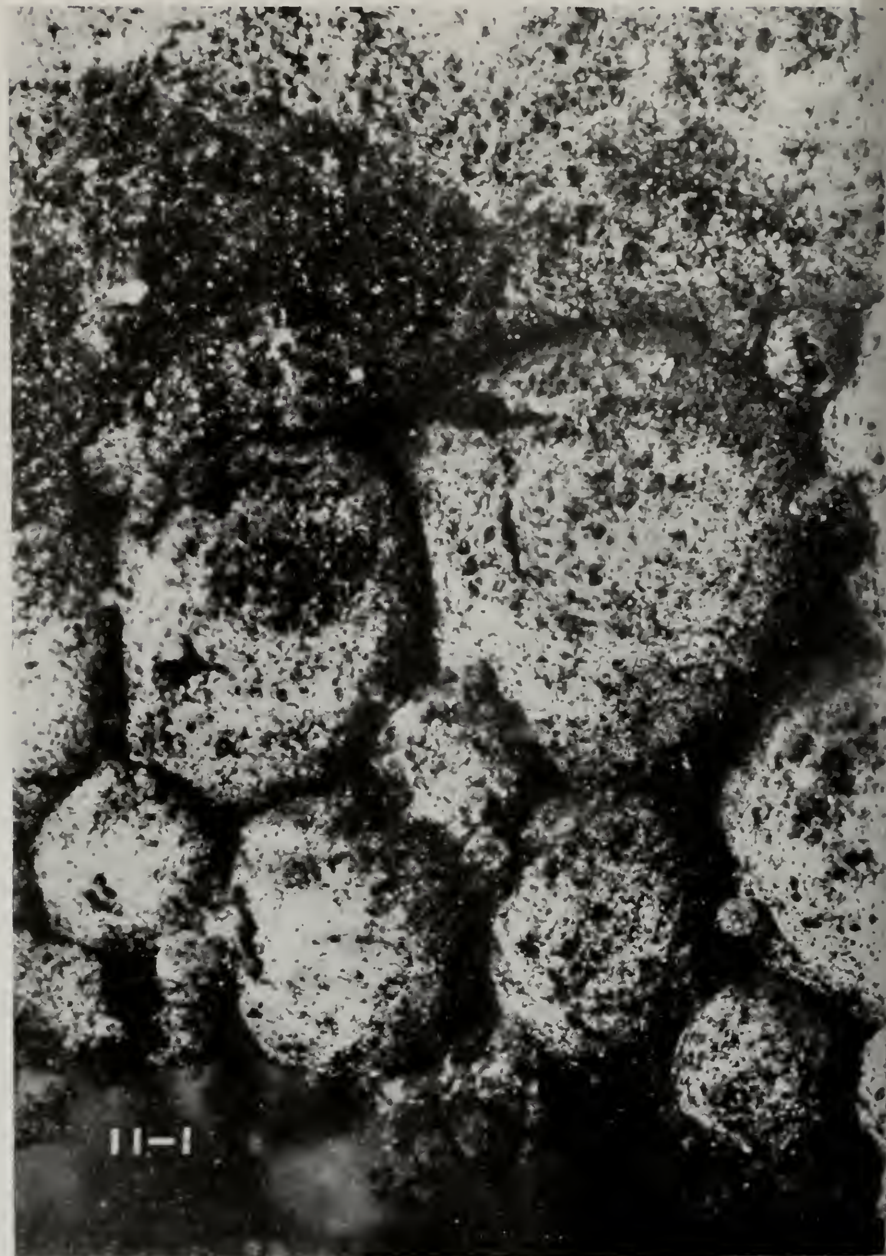

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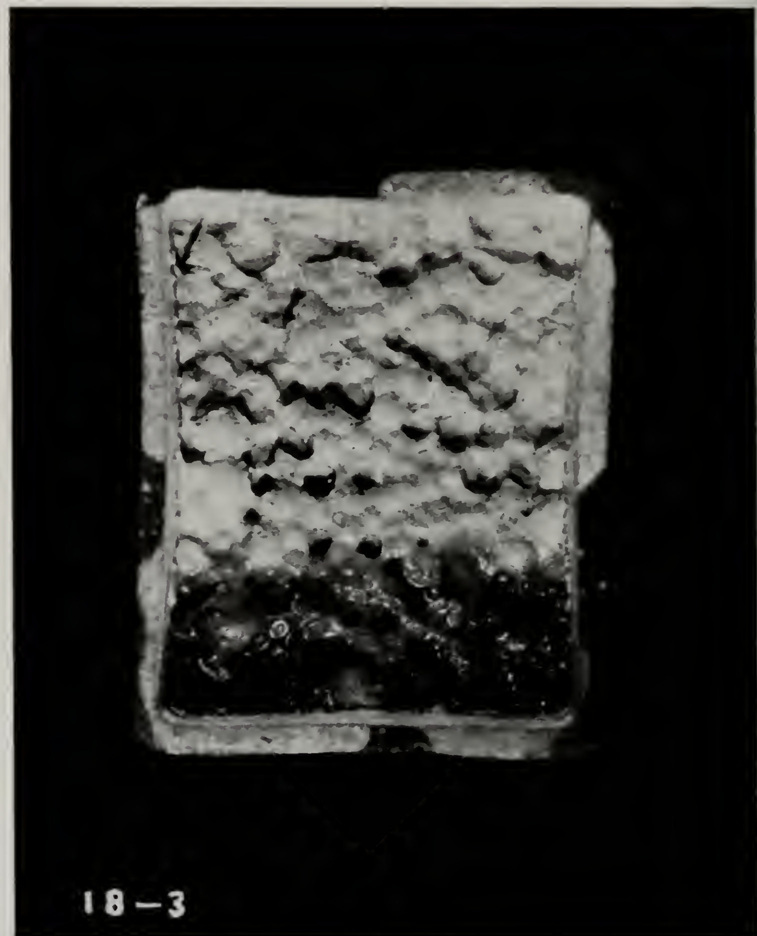

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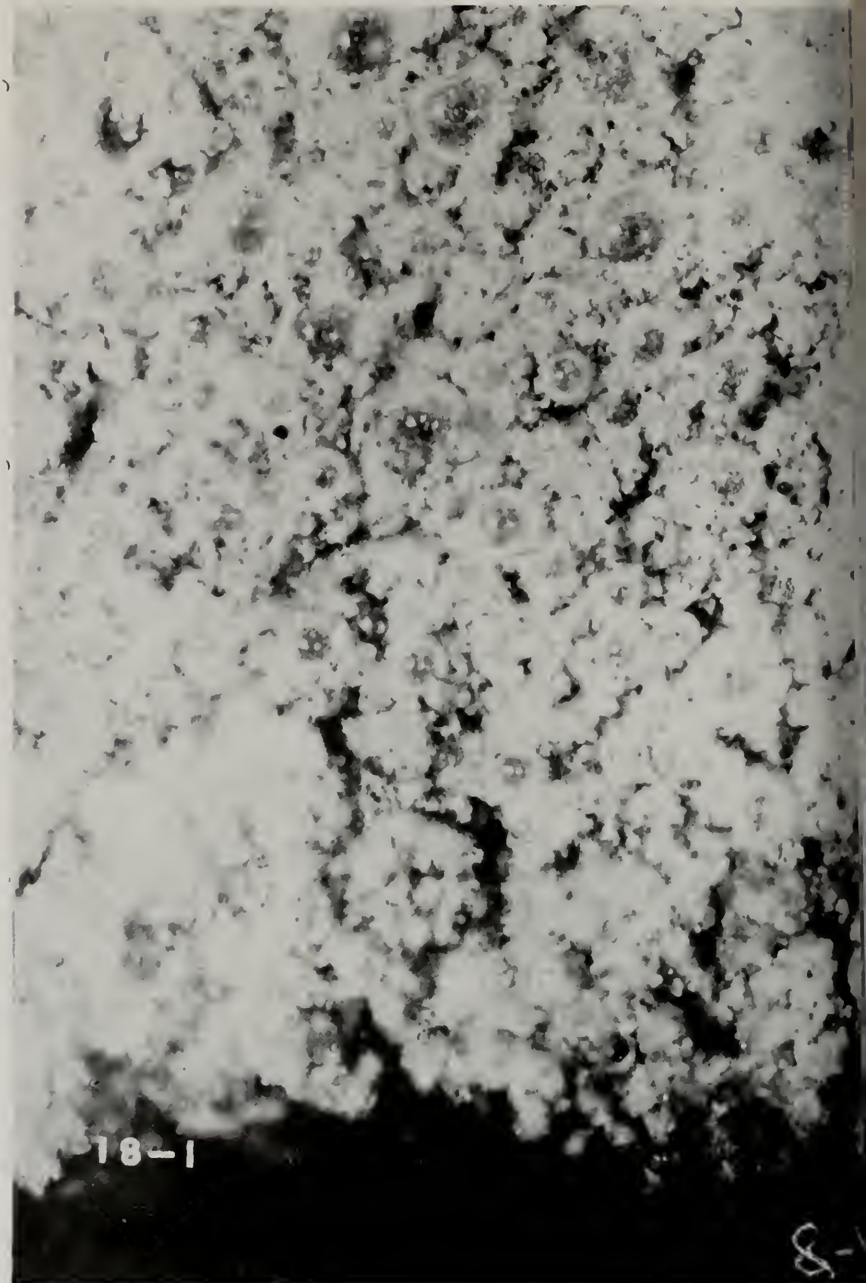

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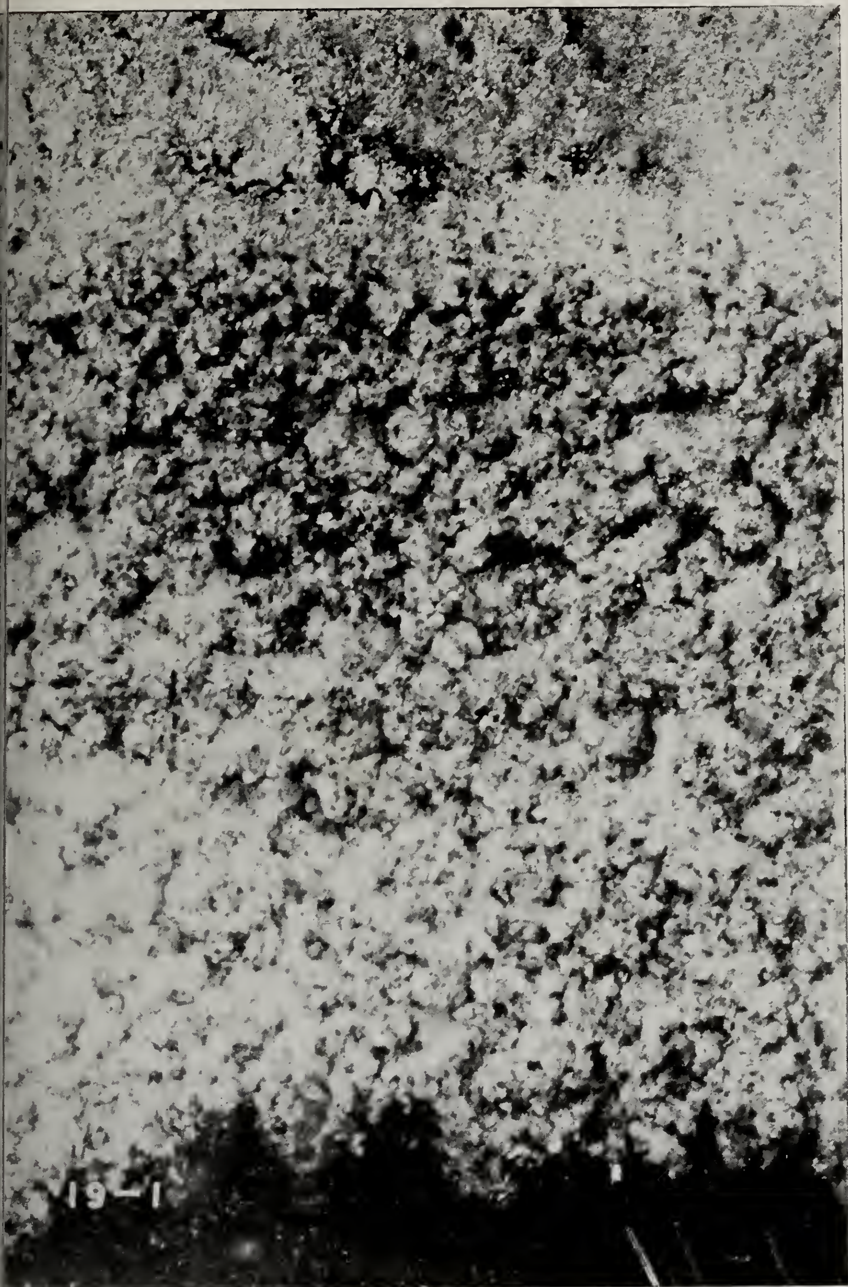

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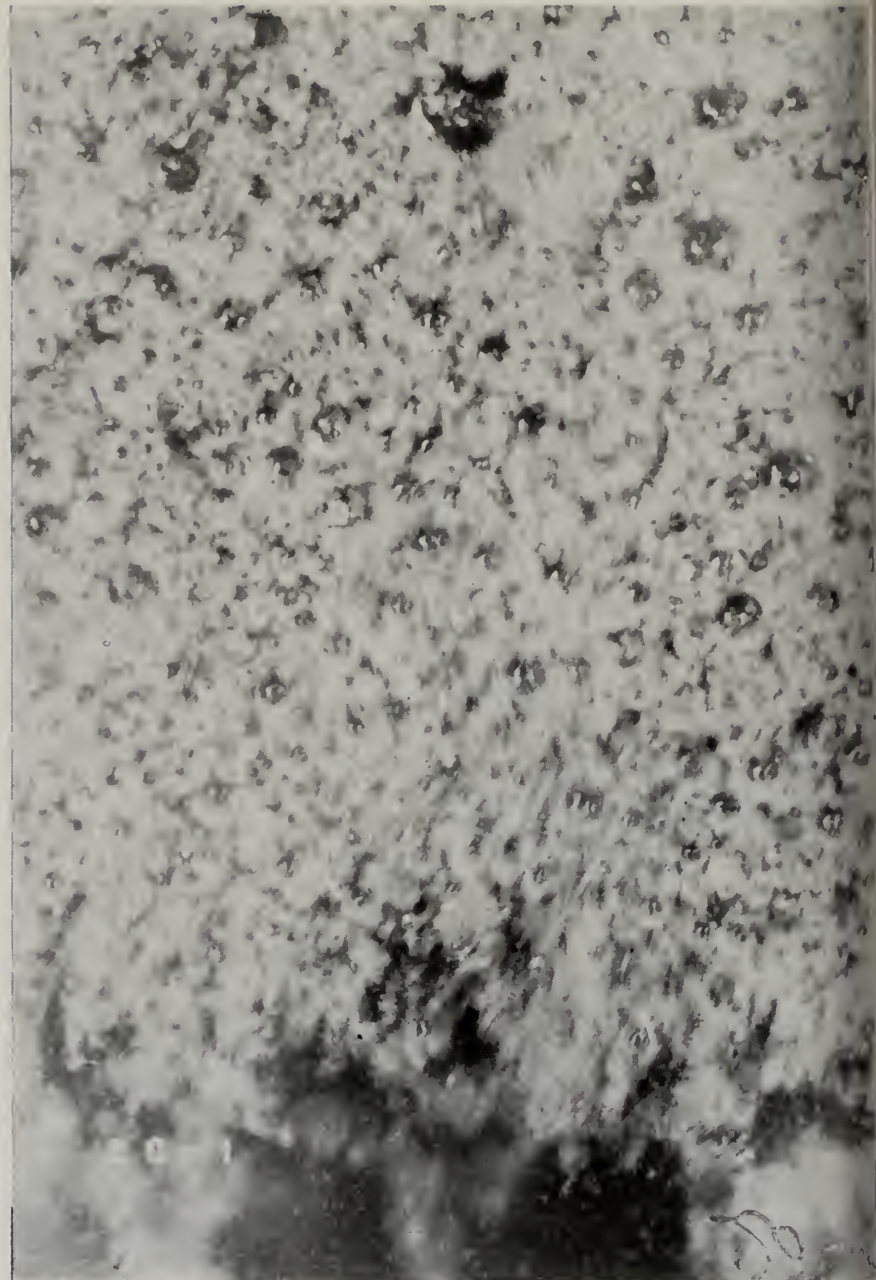

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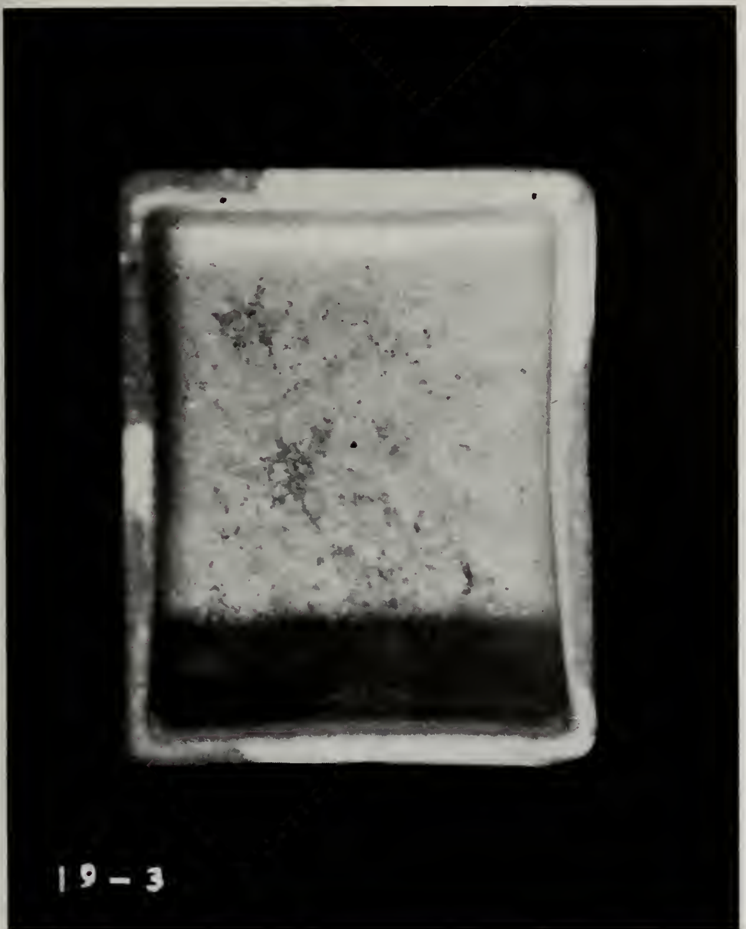

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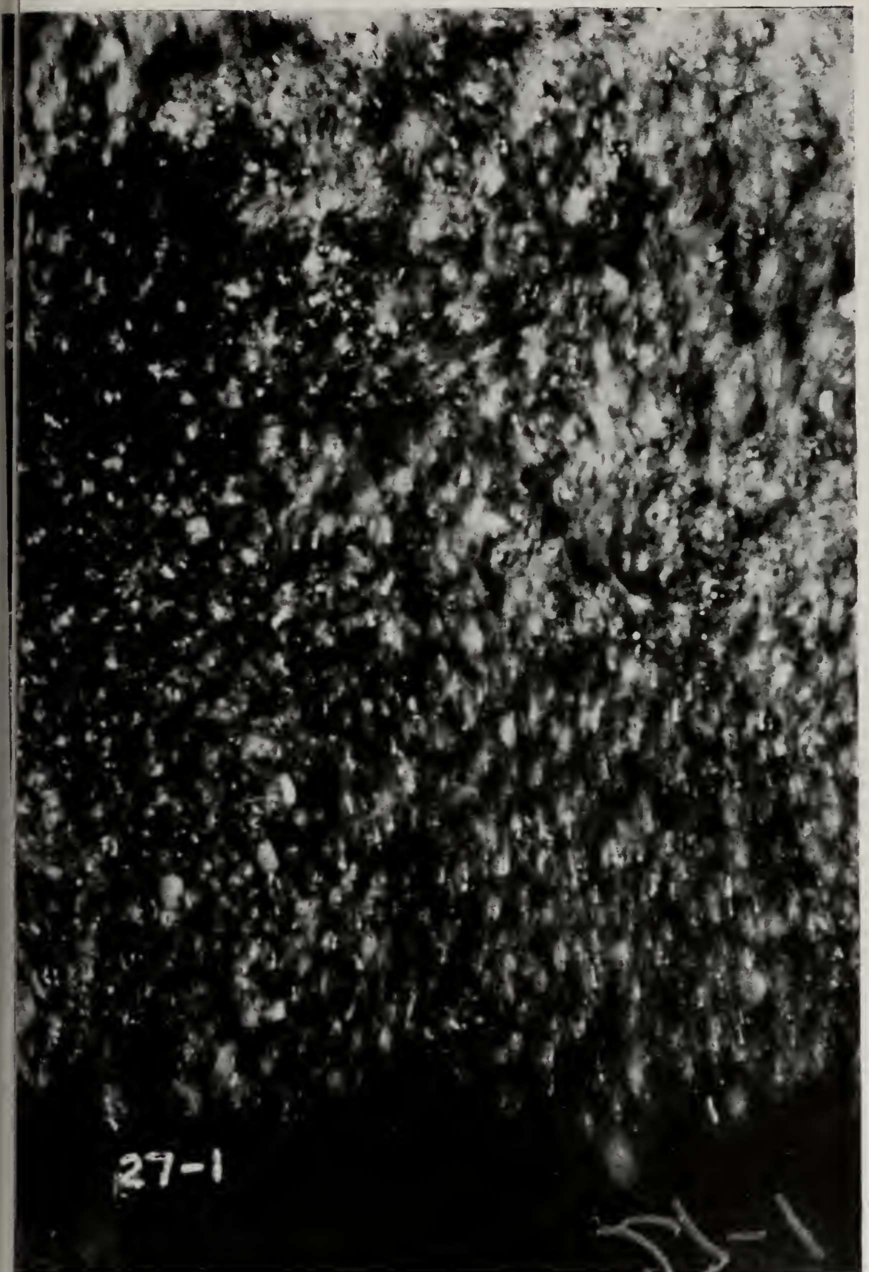

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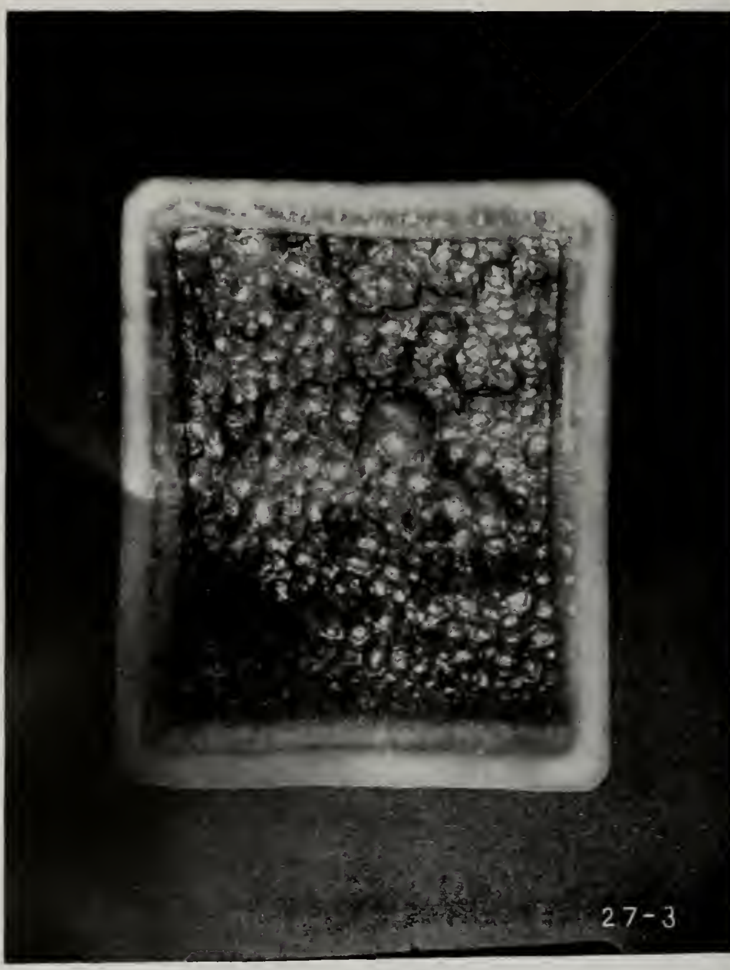

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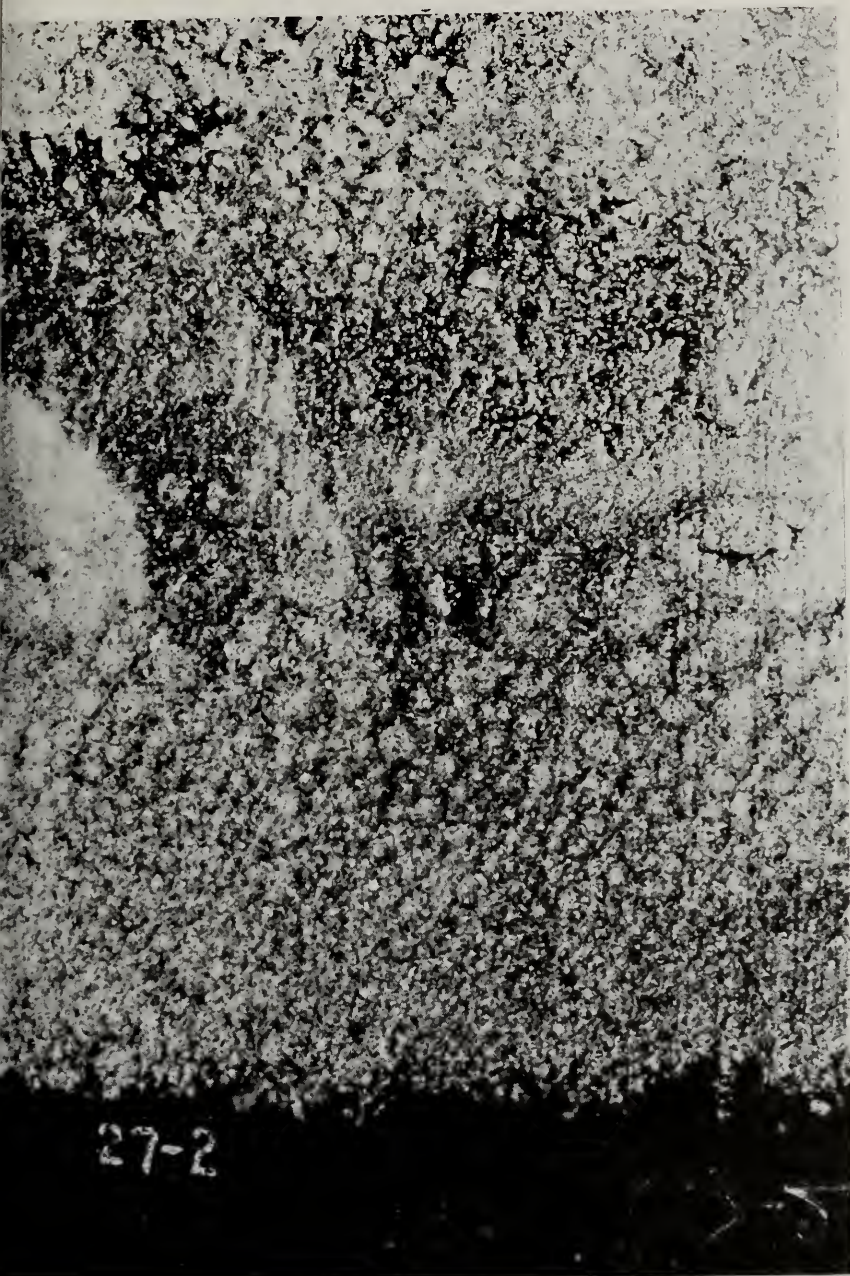

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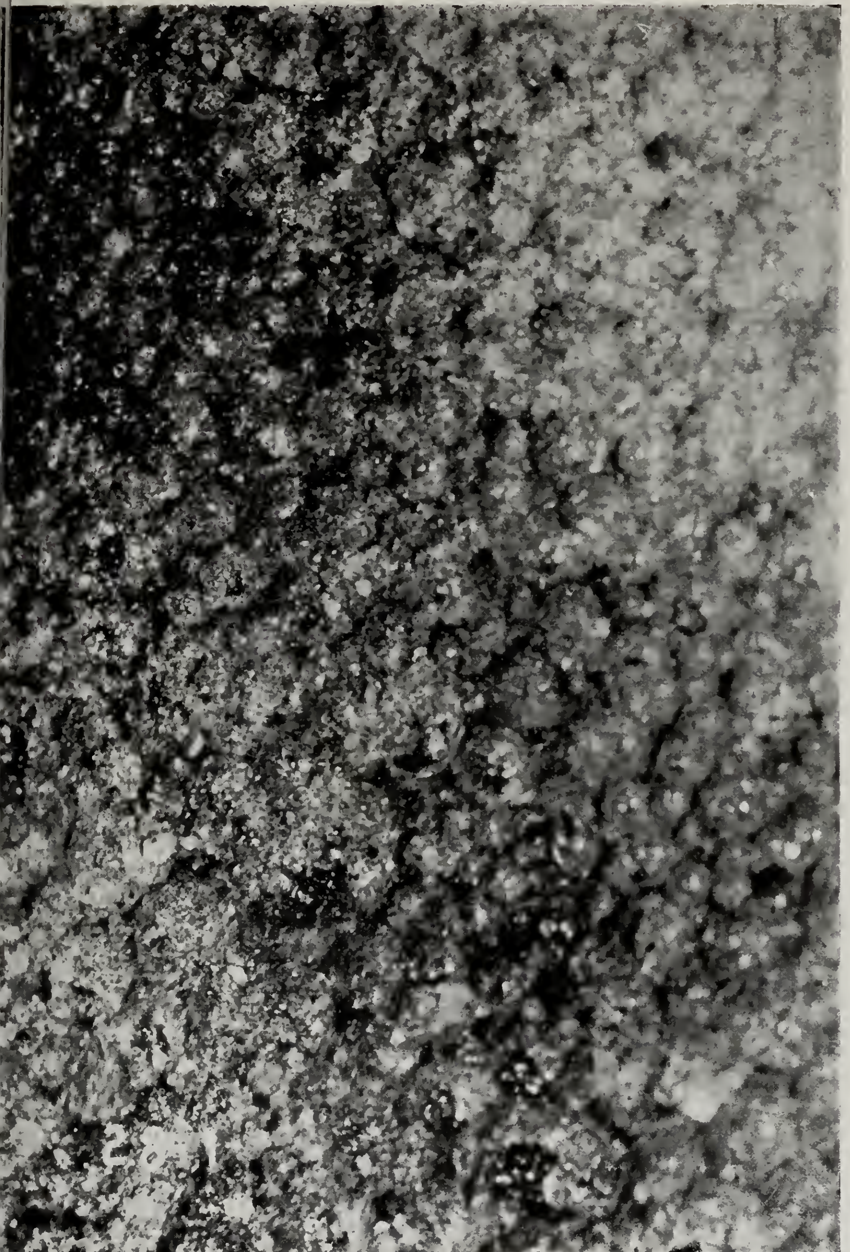

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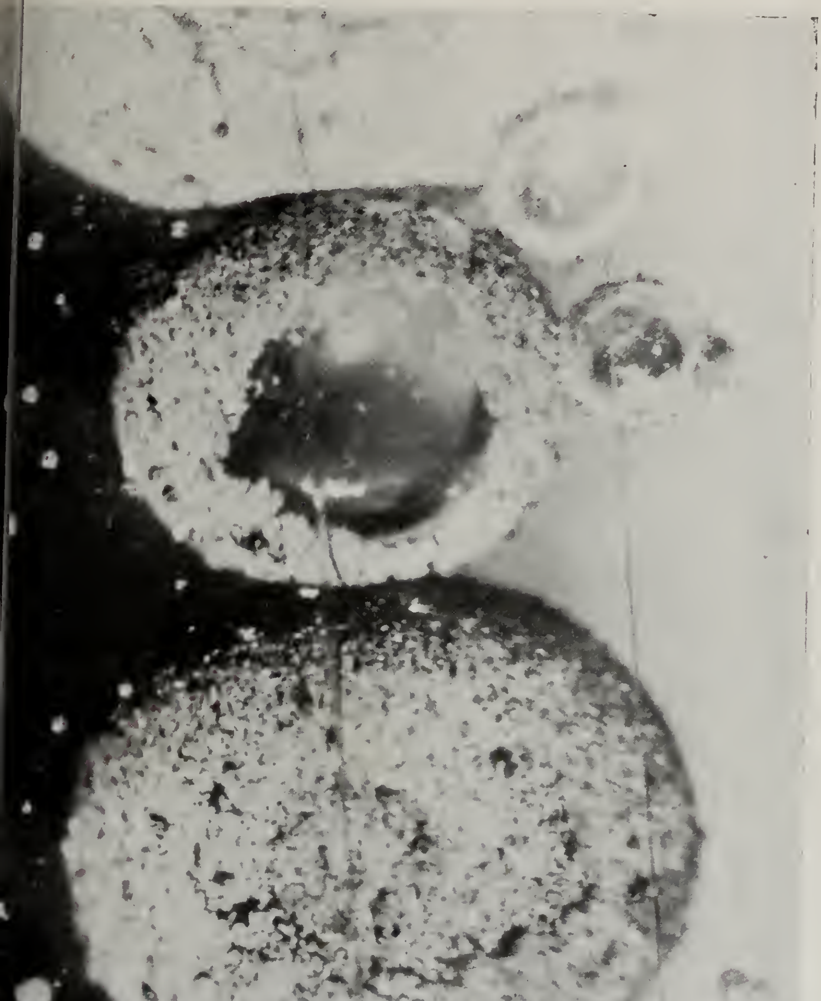

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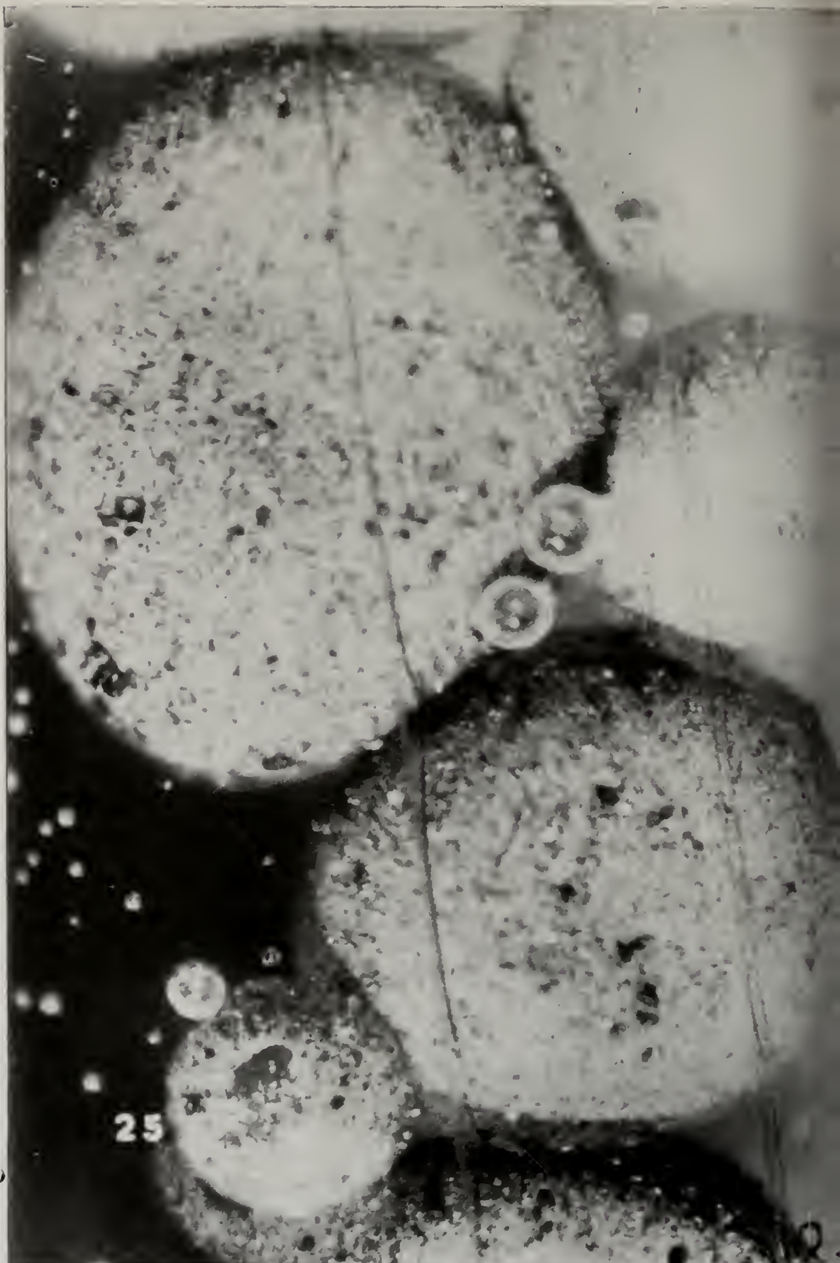

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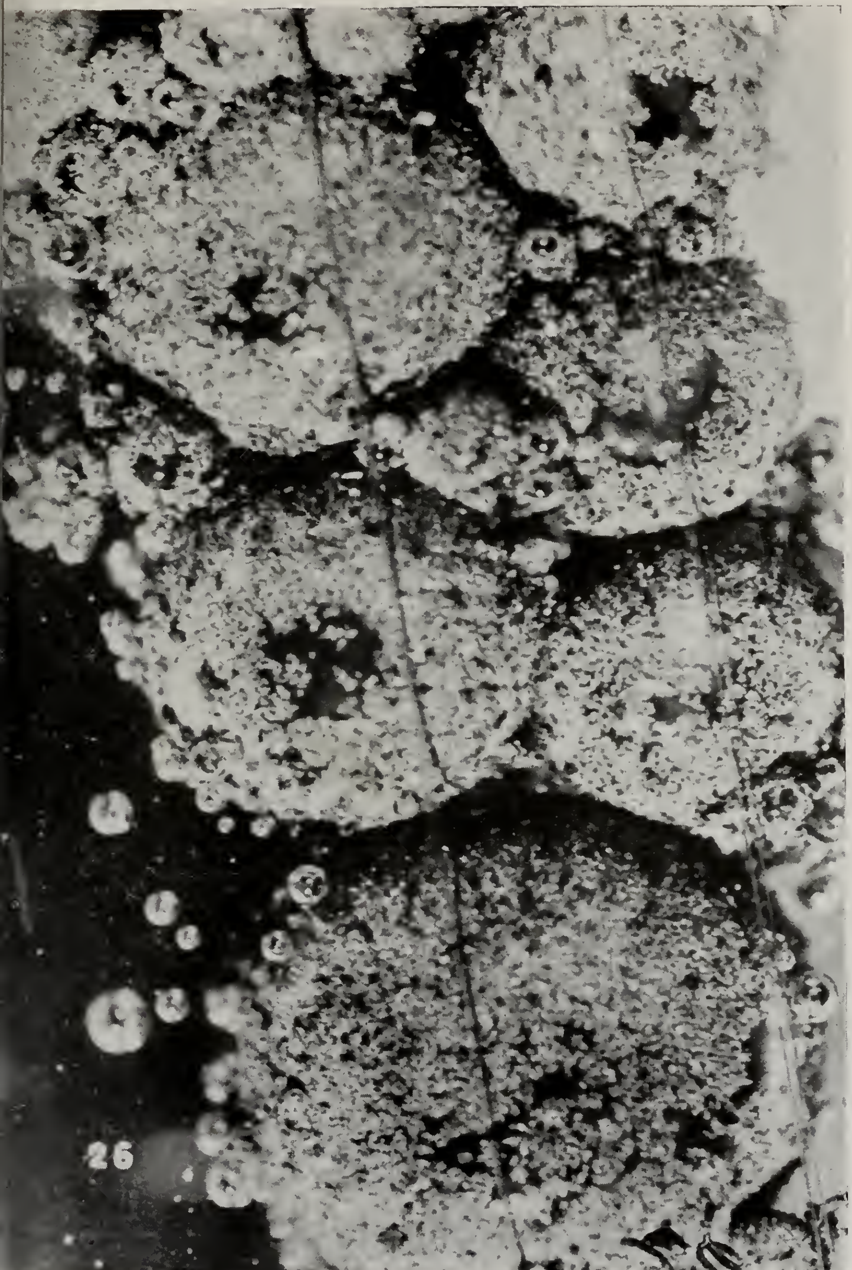
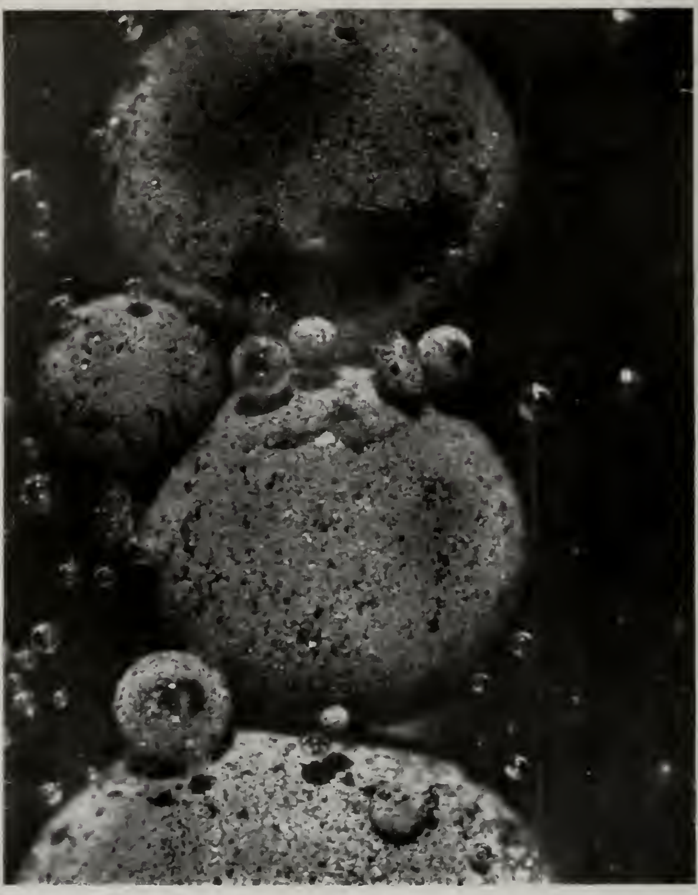
By H. H. WALKER, Deput

Defendant's Exhibit No. 119.



Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Defendant's Exhibit No. 120.



Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

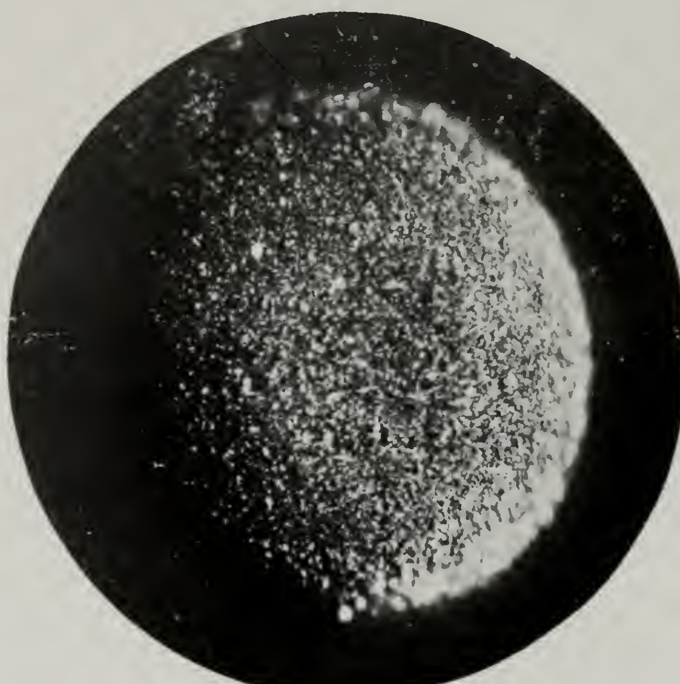
Defendant's Exhibit No. 121.

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Defendant's Exhibit No. 122.

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy

Defendant's Exhibit No. 123.



Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Defendant's Exhibit No. 124.

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Defendant's Exhibit No. 125.

DATE	FLOTATION HEADINGS Weight Dry Tons	Average Daily Tonnage	Assay Percent Copper	FLOT. CONCTS. Weight Dry Tons	Assay Percent Copper	FLOTATION TAILS Assay Percent Copper	% Indicated Recovery	Initial Oil Pounds Per Ton	Oil in Circu'g Load Lbs. Per Ton	Total Oil Pounds Per Ton	Kind of Oil Used
1915											
Apr. 16-30	8,600	573	.96	157	12.78	.74	24.33	0.85			
May 1-25	27,750	1110	.93	495	11.13	.74	21.4	1.08			
June	None										
July 13-23	8,065	733	.74	434	4.23	.54	30.73	1.45			
3rd Quar.	90,104	1251	.72	1363	16.99	.48	34.88	1.20			
4th Quar.	299,522	3256	.78	2874	23.43	.56	28.81	1.02			
Year 1915	425,976	1812	.78	4889	19.95	.56	29.32	1.06			
1916											
1st Quar.	288,320	3168	.89	2952	21.13	.68	24.25	1.04			
2d "	280,424	3081	.79	2846	26.82	.52	34.36	1.45			
3d "	328,120	3566	.82	3516	27.35	53	35.68	1.33			
4th "	352,810	3835	.82	3676	29.64	.52	37.39	0.96			
Year 1916	1,249,674	3414	.83	12990	26.47	.56	33.05	1.19			
1917											
Jan.	127,350	4108	.75	1204	31.89	.45	40.49	1.10			
Feb.	124,900	4461	.78	1177	28.78	.51	35.23	0.53			
Mar.	136,170	4393	.71	1453	25.22	.44	37.89	1.46			
1st Quar.	388,420	4269	.74	3834	28.47	.47	37.84	1.04			
Aver. of all Oper. to Date	2,064,070	3127	.804	21713	25.352	.543	33.139	1.13			
Jan. 7	2,058		.98	19.	22.47	.78	24.07	9.72	*2.43	12.15	Jones
Mar. 13	205		.67	3.3	9.10	.53	25.50	24.19			Stove
Mar. 14	122		.80	1.4	27.60	.48	41.00	22.80			Coal Tar Stove
Mar. 21	135		.69	1.4	25.10	.44	37.00	37.79			Taft
Mar. 27	2,300		.63	44.7	11.73	.41	36.20	32.27			Sulphur
Apr. 2	1,700		.61	21.0	14.87	.43	30.40	10.54			Gashouse tar
Apr. 2	1,965		.65	23.2	14.87	.48	27.00	.34			"
Apr. 4	3,250		.57	21.8	25.73	.40	30.30	8.10	3.2	11.3	"

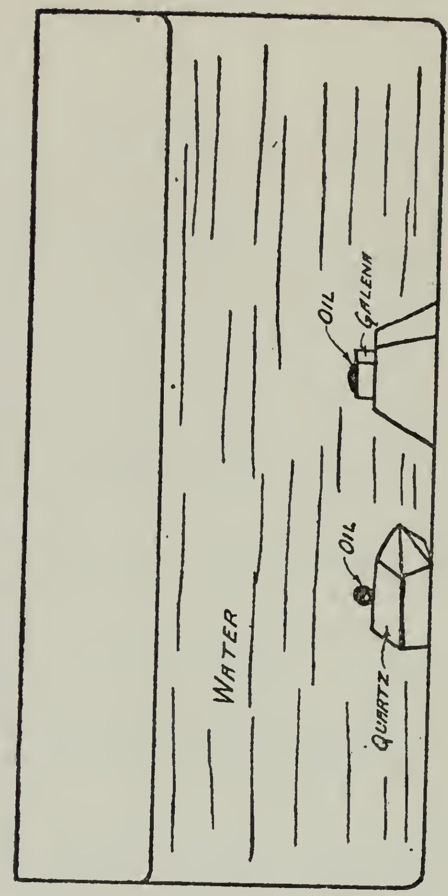
* Approximate quantity.

Recompiled at Butte.
April 19, 1917.

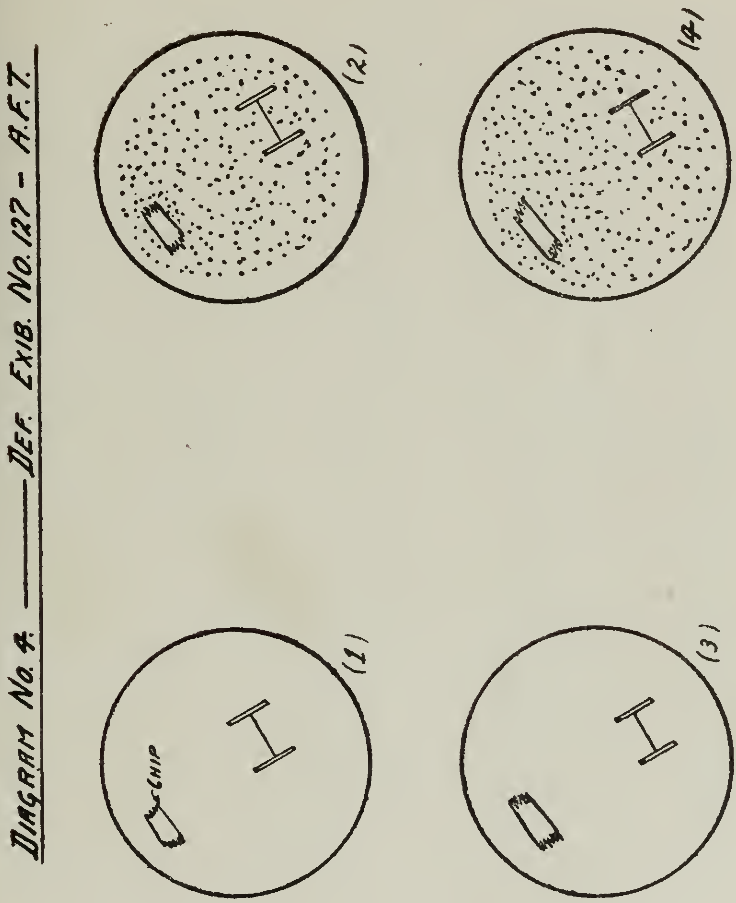
(Signed) O. WISER,
Metallurgical Engineer.

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

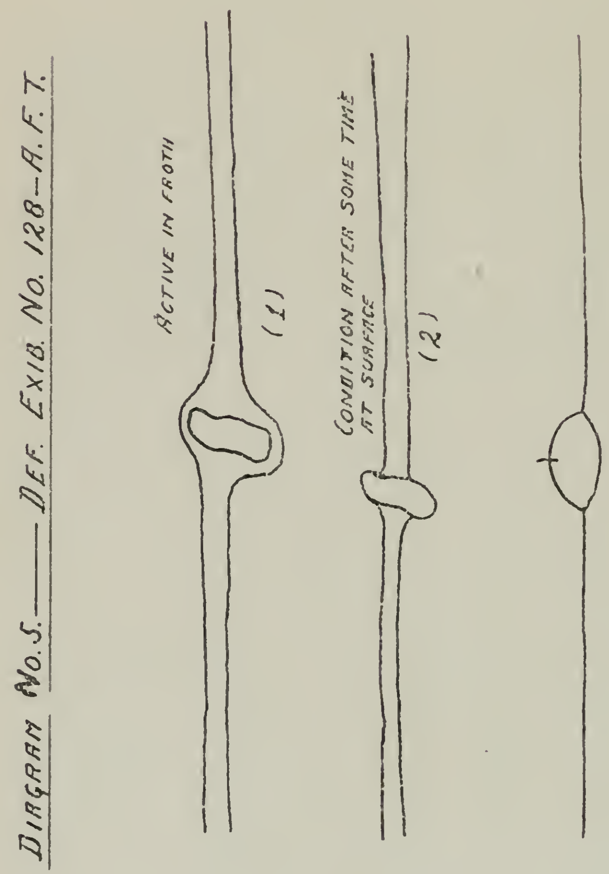
DIAGRAM NO. 3. —— DEF. EXIB. NO. 126 - A.F.T.



Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

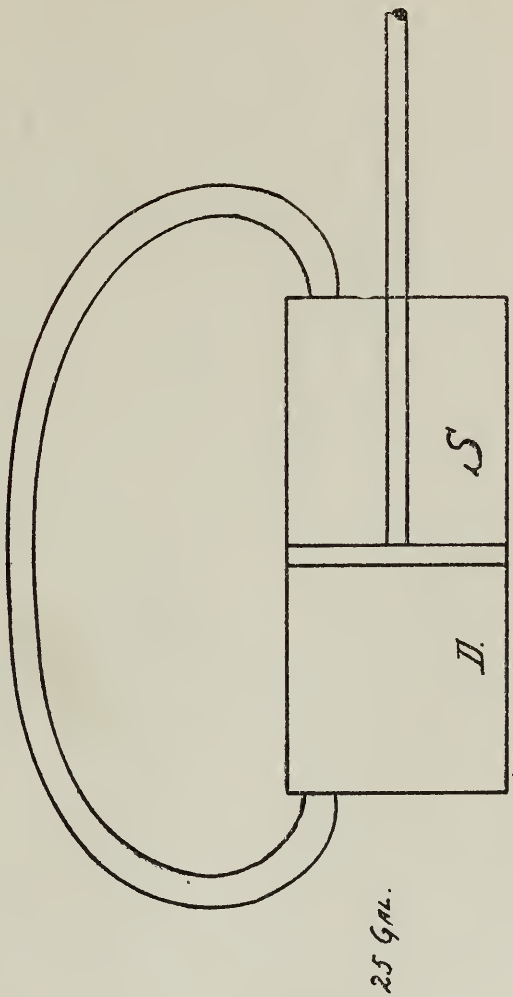


Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.



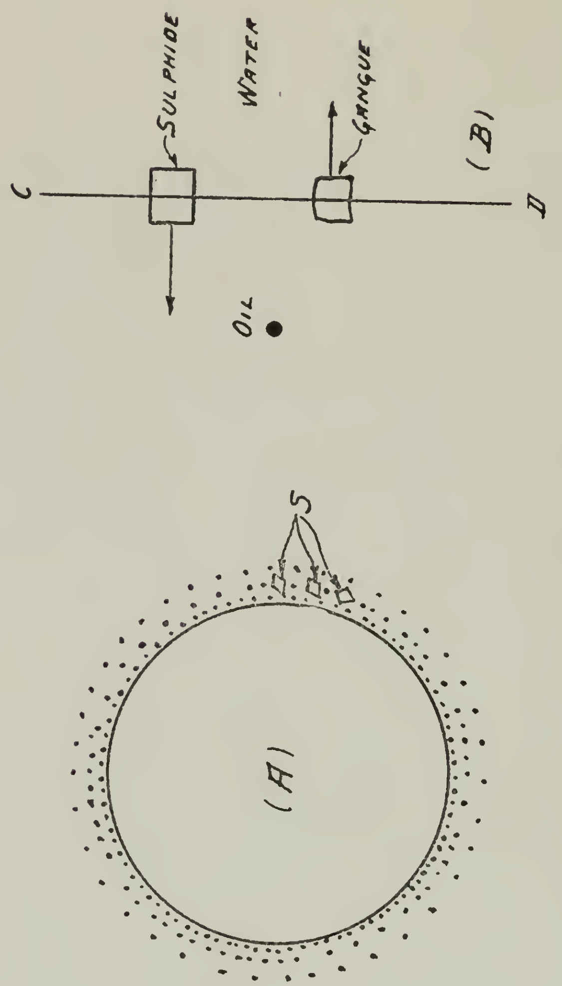
Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

DIAGRAM No. 6.——DEF. EXIB. No. 129——A.F.T.

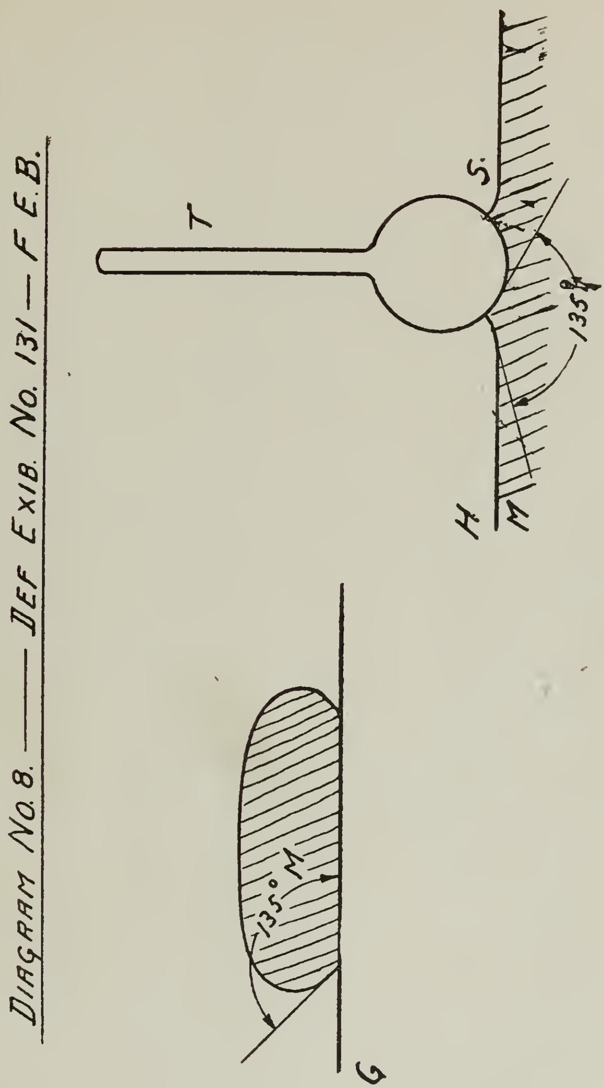


Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

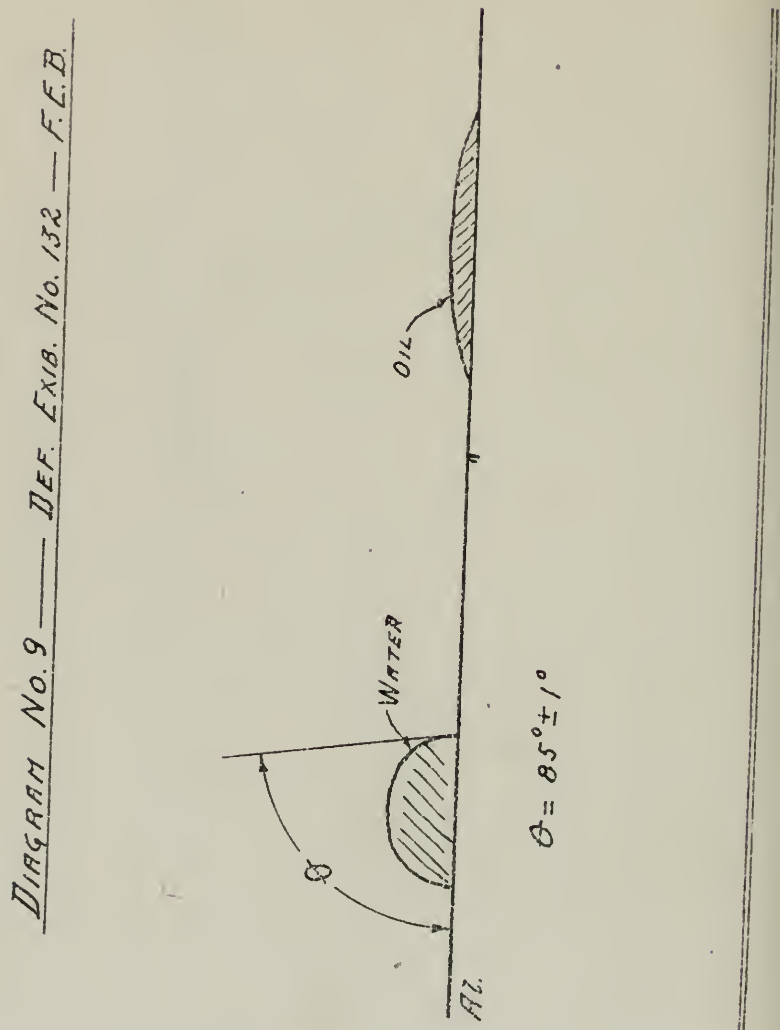
Diagram No. 7.—Def. Exib. No. 130.—A. F. T.



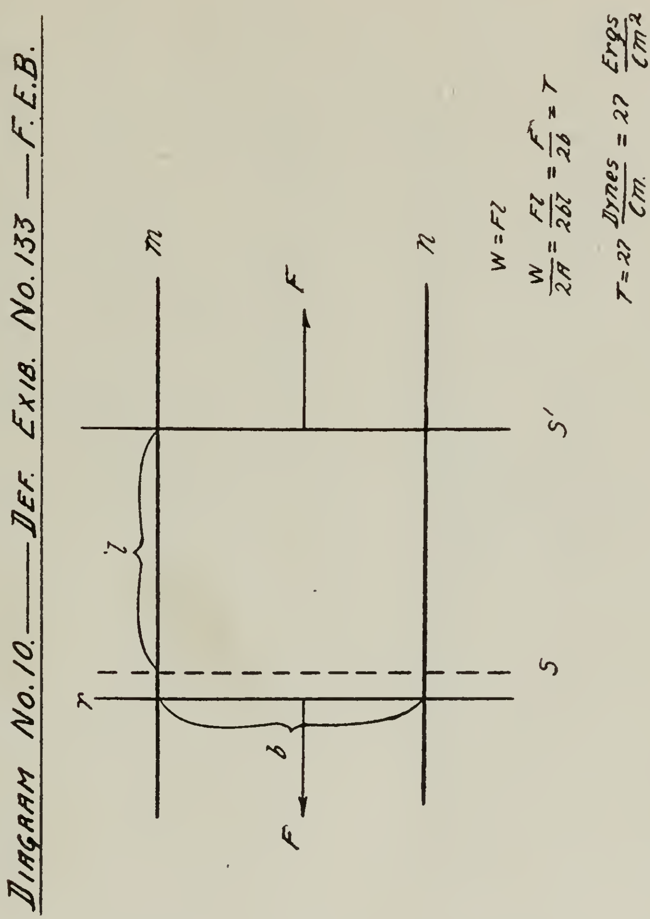
Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.



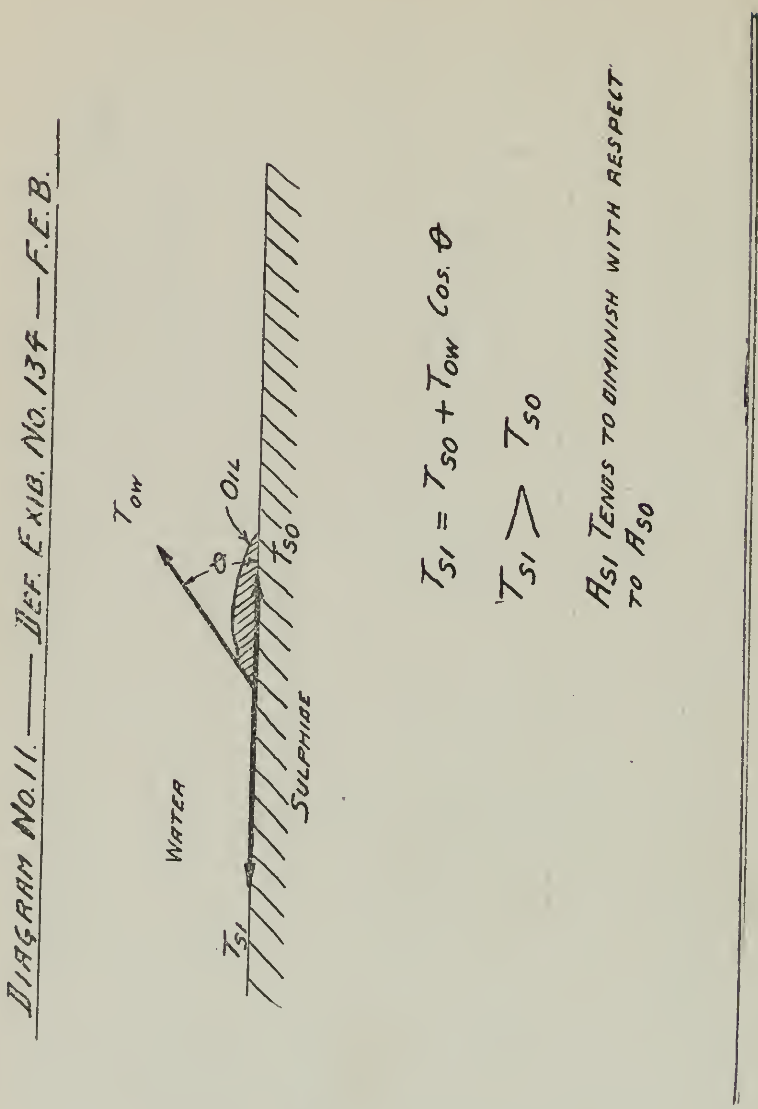
Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.



Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

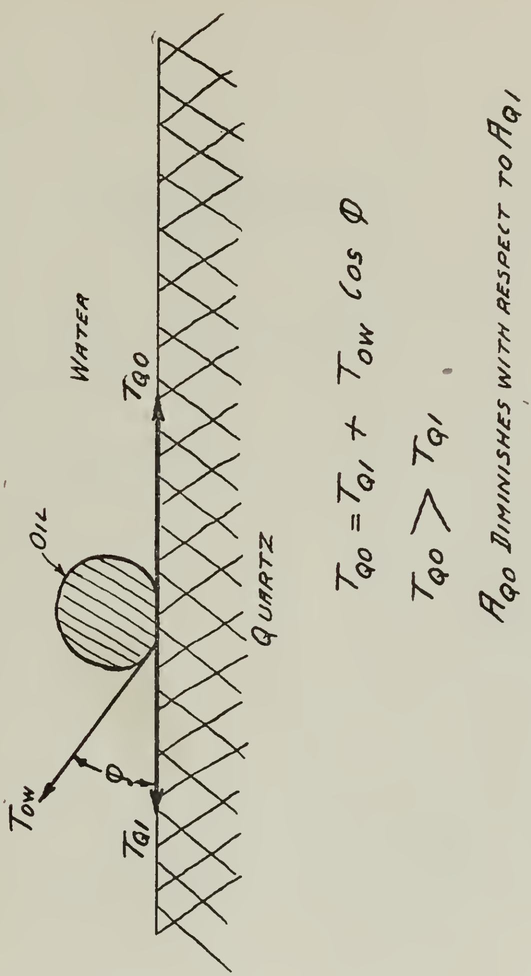


Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.



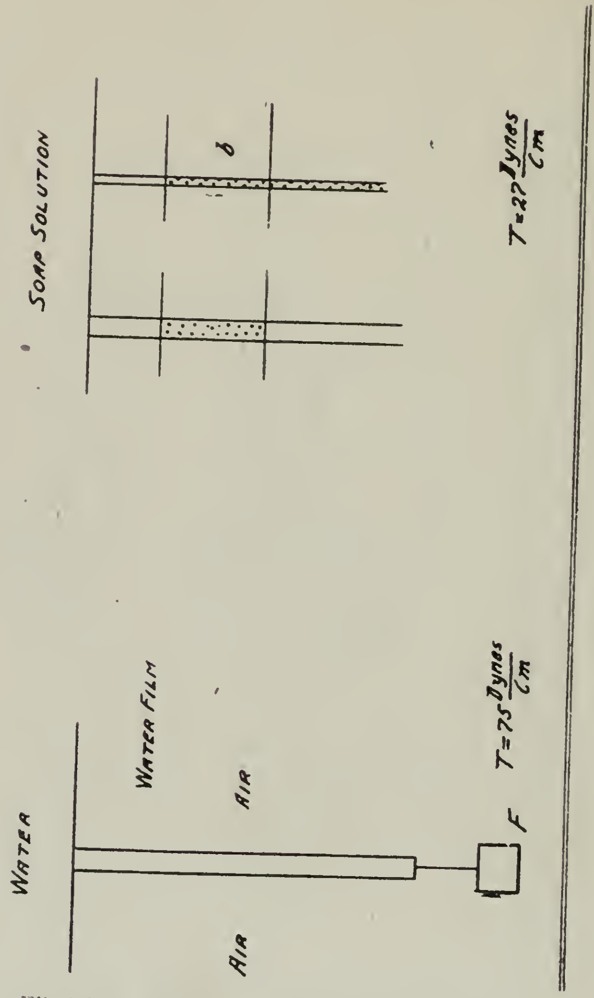
Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

DIAGRAM NO. 12.——DEF. EXIB. NO. 135——F. E. B.



Filed May 18, [illegible]. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

DIAGRAM No. 13. —— DEF. EXIB. No. 136 — F. E. B.



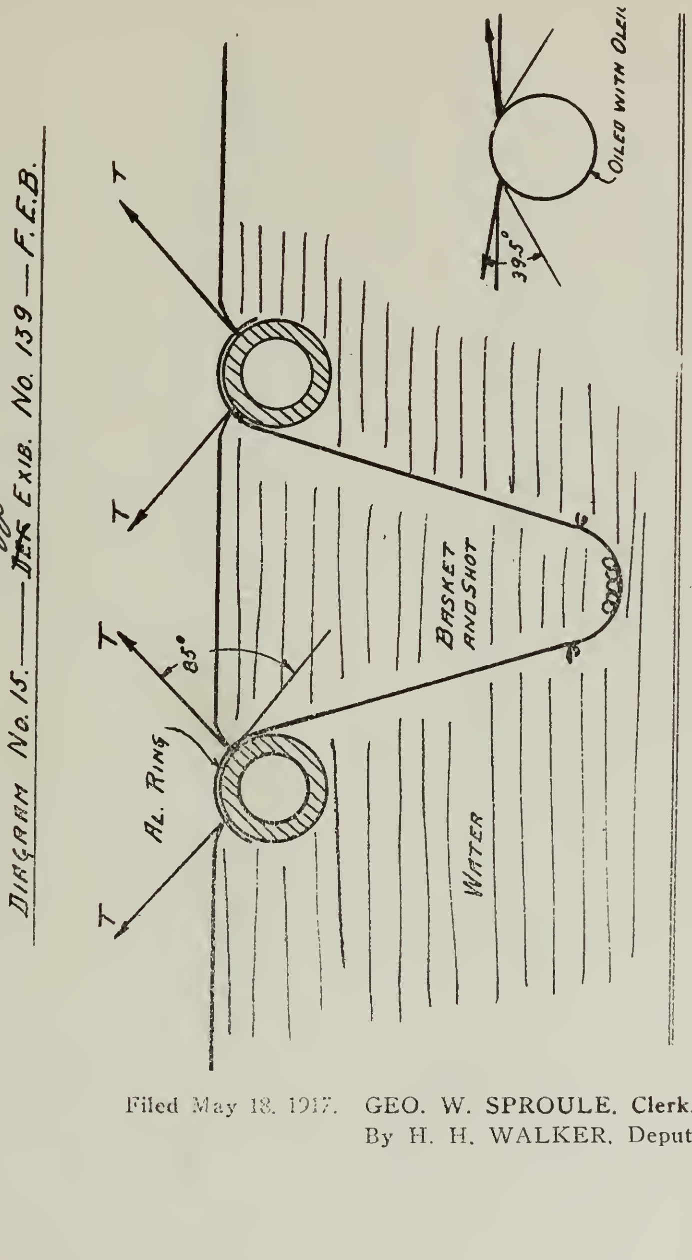
Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

DIAGRAM NO. 14 — DEF. EXIB. NO. 137 — F.E.B.

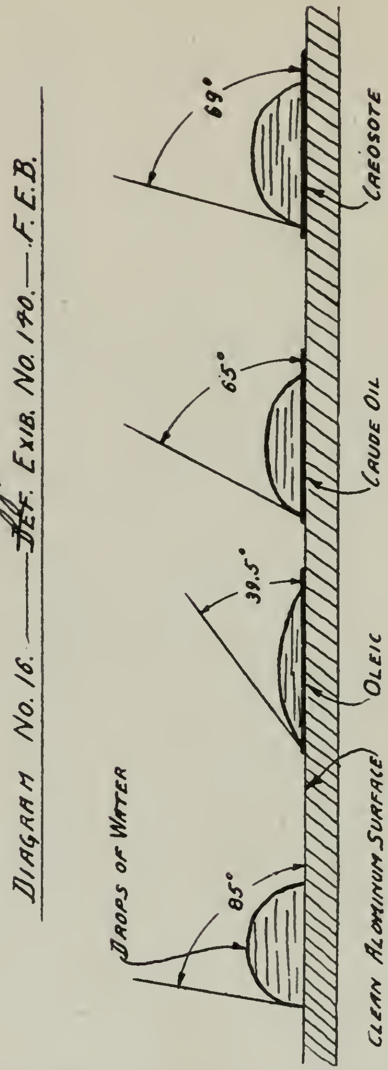
Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Defendant's Exhibit No. 138.

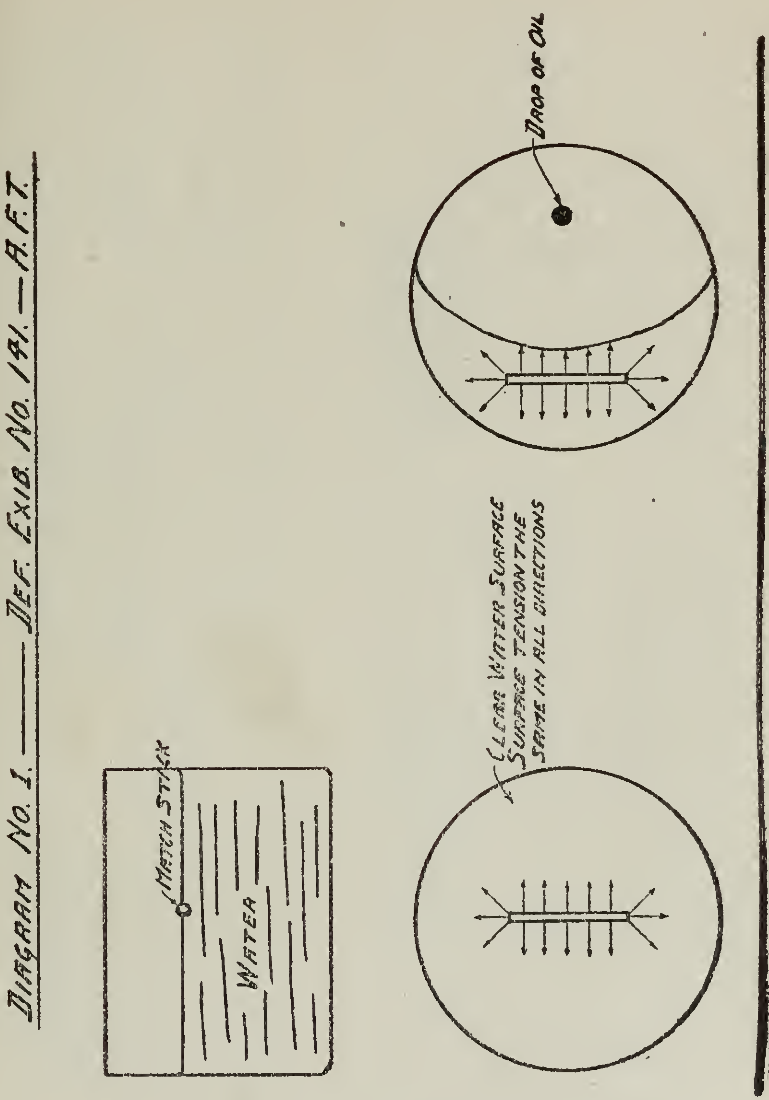
(Used by Mr. Williams to identify Prof. Taggart's article. This exhibit was identified but not admitted in evidence.)



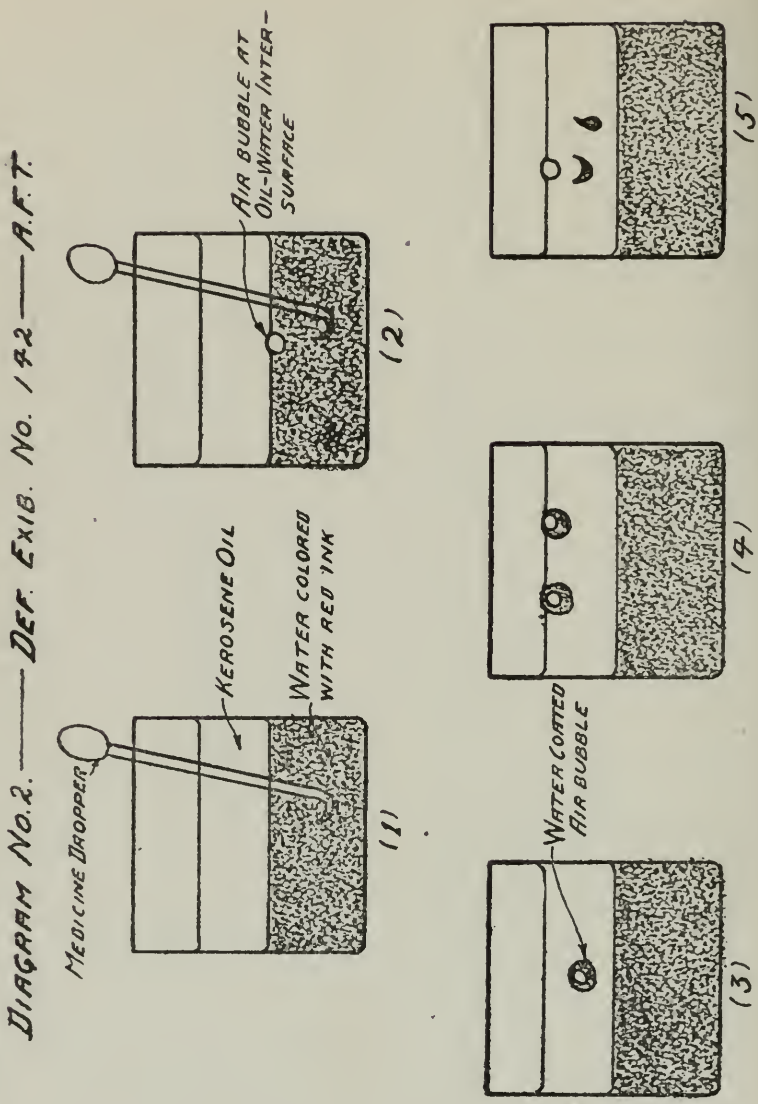
Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.



Filed May 18, 1917. GEO. W. SPROULE, **Clerk**.
By H. H. WALKER, **Deputy**.



Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.



Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Plaintiffs' Exhibit No. 143.

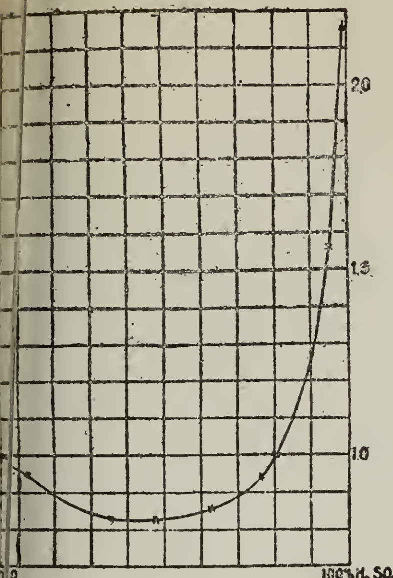


Fig. 14a.

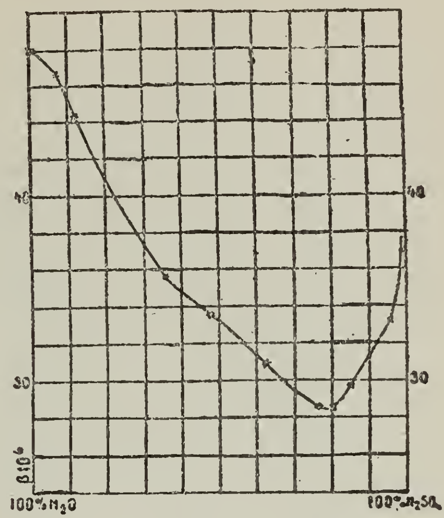


Fig. 14b.

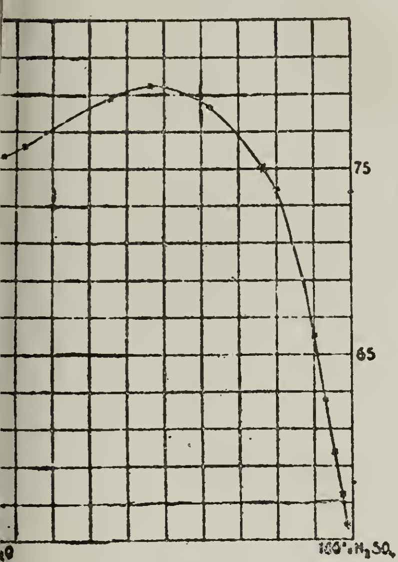


Fig. 14c.

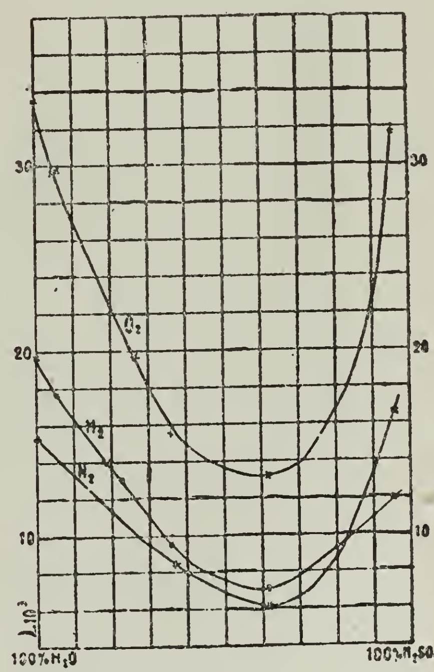
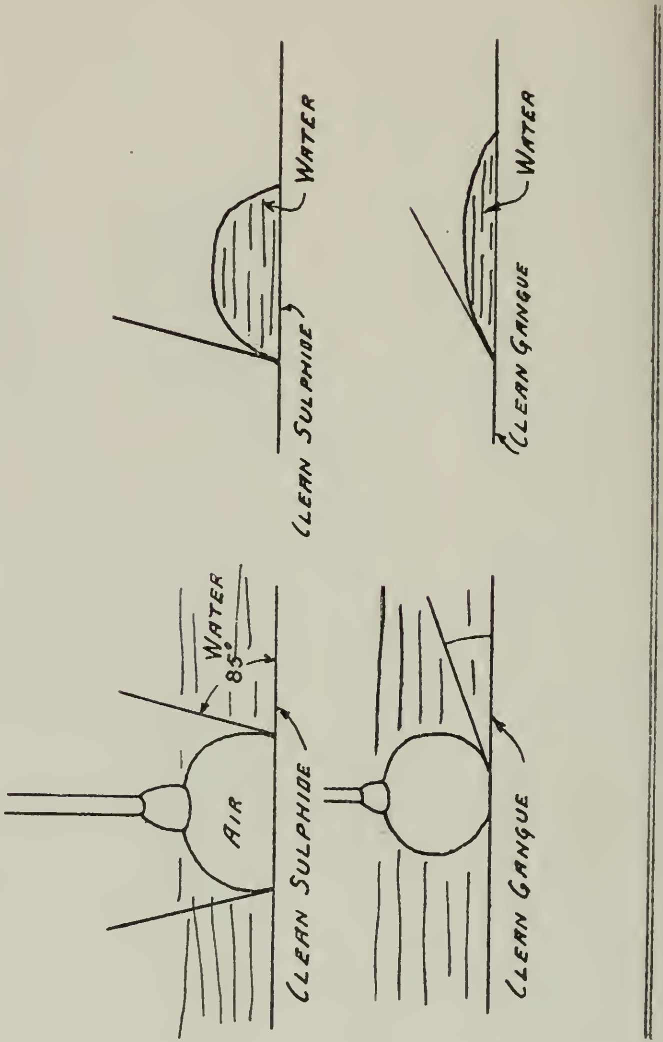


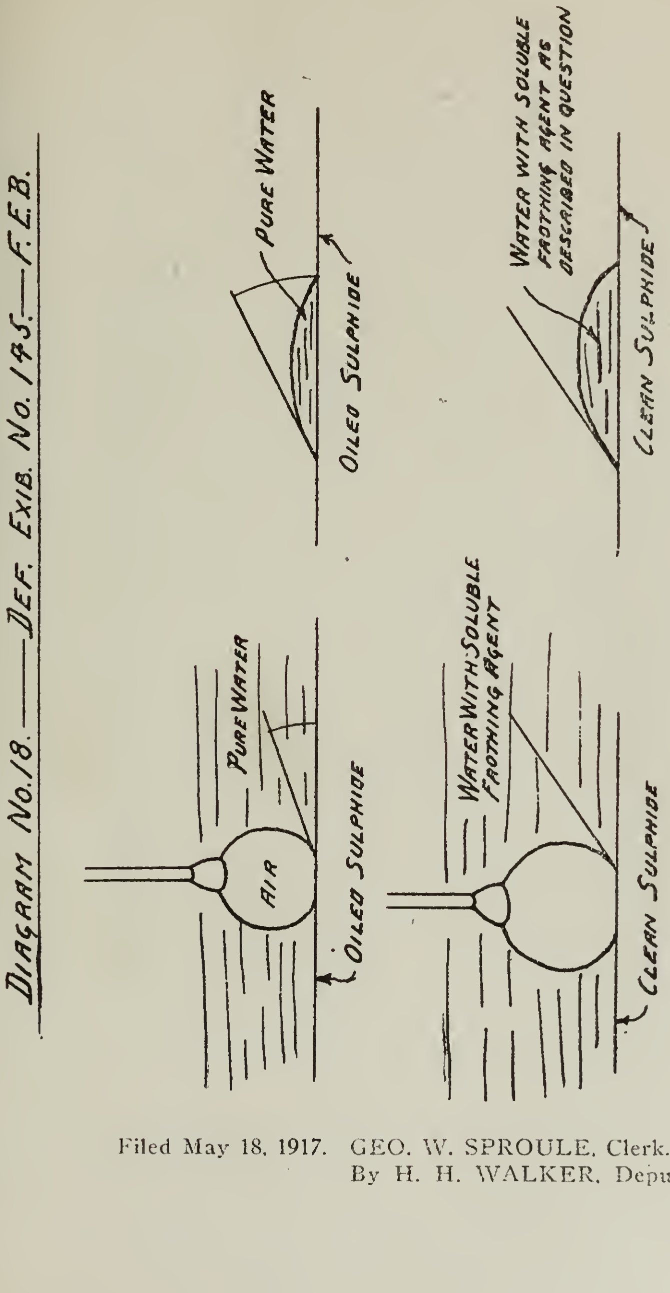
Fig. 14d.

Filed Sept. 11, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

DIAGRAM No. 12.—DEF. EXIB. No. 144.—F. E. B.

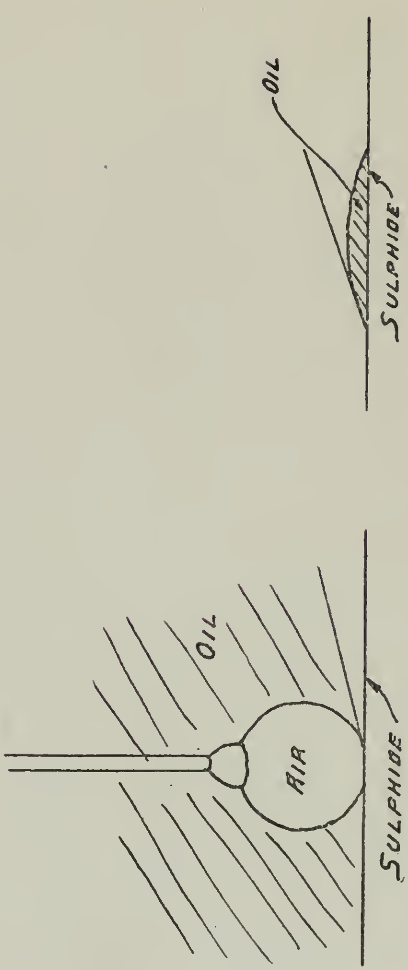


Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

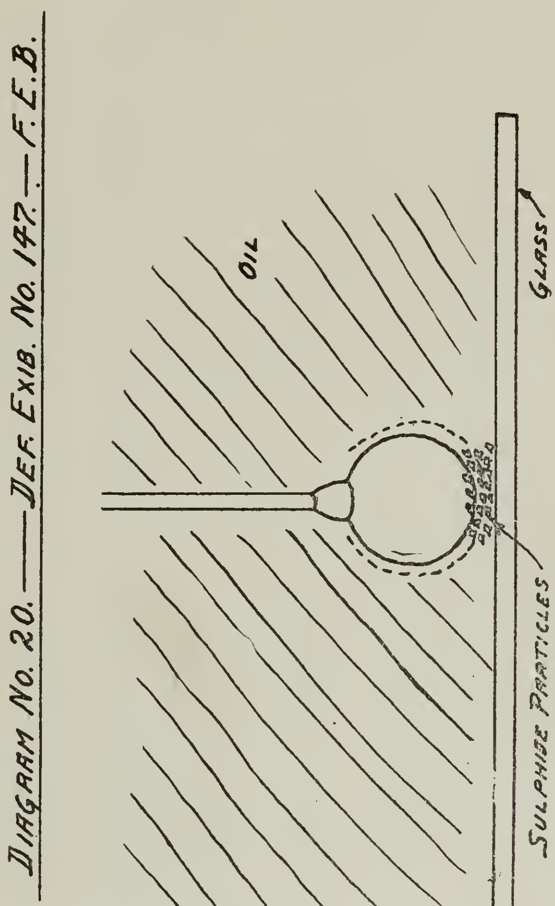


Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

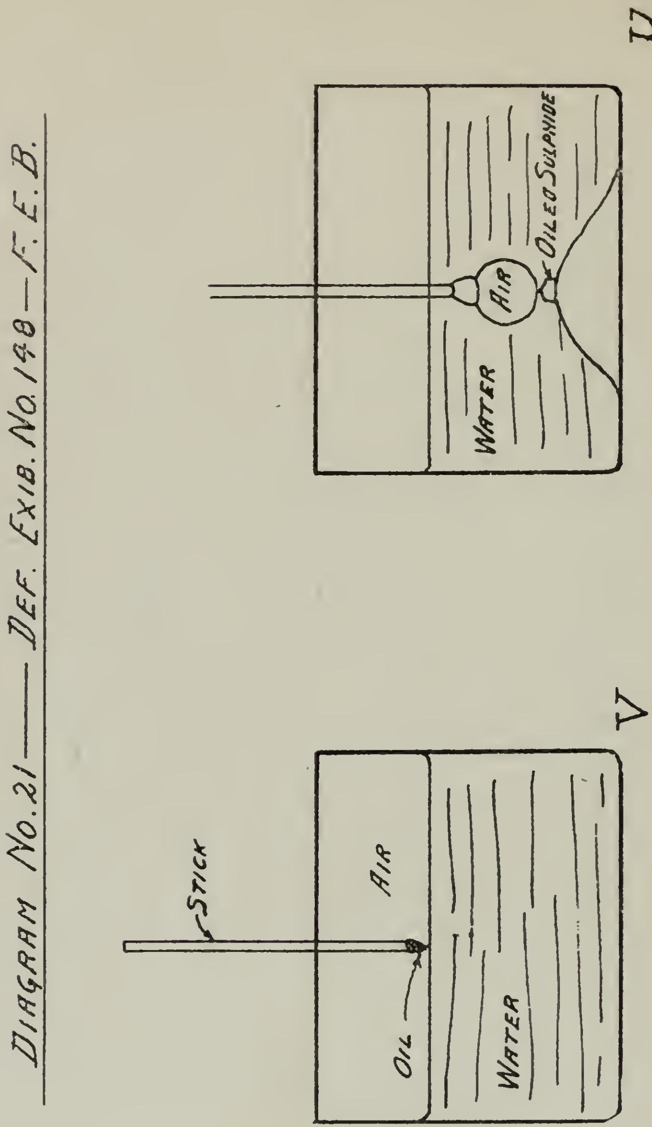
DIAGRAM No. 19.—DEF. EXHIB. No. 146—F.E.B.



Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

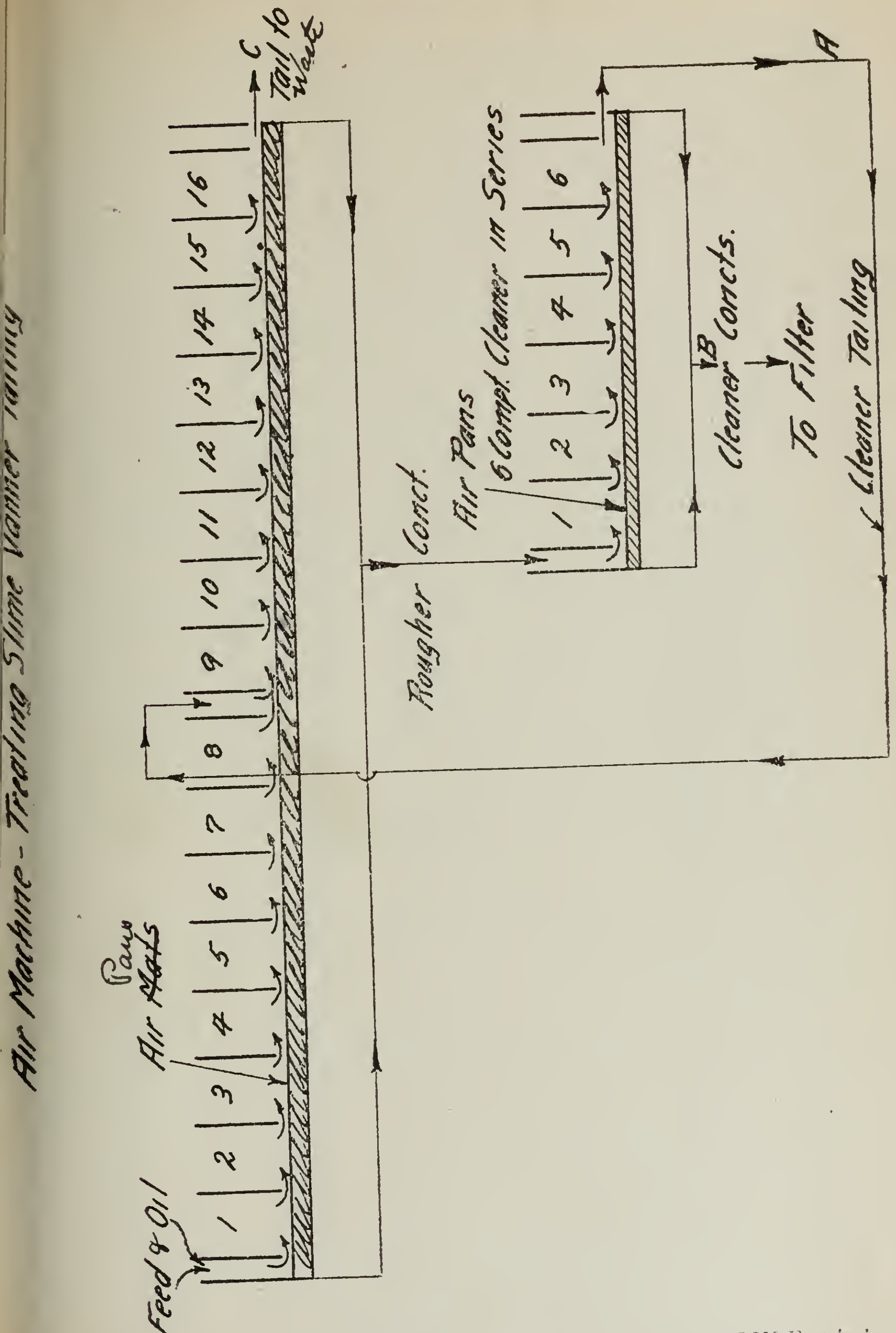


Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.



Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Defendant's Exhibit No. 149.



Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Defendant's Exhibit No. 150.

RAY CONSOLIDATED COPPER COMPANY
HAYDEN PLANT
FLOTATION OPERATIONS
Retreating Vanner Concentrate Products

PERIOD	FLOT. HEADS Tons	FLOT. HEADS Assay % Cu.	FLOT. CONCTS. Tons	FLOT. CONCTS. Assay % Cu.	TAILS Assay % Cu.	FLOTATION Copper Appr. %	FLOTATION Recovery Estm. %	NEW OILS Lbs. Per Ton	OIL ASSAYS PERCENTS Flotation Heads Including Circul. Load	OIL ASSAYS PERCENTS Concts.	OIL ASSAYS PERCENTS Tails
1914											
4th Quarter	8821	6.87	1892	29.78	.617	92.94	92.94	4.31			
1915											
1st Quarter	17849	6.42	3752	28.94	.425	94.76	94.76	3.47			
2d "	8802	5.60	1702	27.33	.397	94.28	94.28	5.28			
3d "	17328	5.73	3797	24.17	.554	92.45	92.45	4.92			
4th "	19558	6.12	4200	26.44	.574	92.64	92.63	4.42			
YEAR	63537	6.029	13451	26.61	.502	93.439	93.436	4.41			
1916											
1st Quarter	20190	4.967	3629	25.37	.496	91.80	91.80	3.34			
2d "	22750	5.460	4362	26.62	.441	93.47	93.47	3.23			
3d "	22750	5.840	4767	26.59	.316	95.73	95.73	3.22			
4th "	27275	6.099	6086	26.38	.273	96.52	96.52	3.54			
YEAR	92965	5.630	18864	26.30	.375	94.69	94.69	3.36			
1917											
January	9300	6.24	2267	23.99	.456	94.48	94.48	20.02			
February	8550	6.63	2289	23.63	.422	95.33	95.33	18.77	1.07	2.87	.10
March	11063	6.70	3377	21.07	.368	96.19	96.19	21.19	.97	3.15	.033
1st Quar. Average	28913	6.531	7983	22.76	.412	95.42	95.42	20.10	1.01	3.03	.062

Hayden 3/29/1917
Copied Butte, Apr. 23, 1917.

(Signed) E. W. ENGLEMANN,
Flotation Foreman.

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Defendant's Exhibit No. 151.

HAYDEN PLANT

FLOTATION OPERATIONS

Treating Slime Vanner Heading & Slime Vanner Tailing

PERIOD	FLOT. HEADS Tons	FLOT. HEADS Assay % Cu.	FLOT. CONCTS. Tons	FLOT. CONCTS. Assay % Cu.	TAILS Assay % Cu.	FLOTATION Copper Appr. %	FLOTATION Recovery Estm. %	OILS Lbs. Per Ton	OIL ASSAYS PERCENTS Flotation Heads Including Circul. Load	OIL ASSAYS PERCENTS Concts.	OIL ASSAYS PERCENTS Tails
1915											
2d Quarter	33,721	1.170	1,045	20.84	.516	57.54	57.32	1.94			
3d "	95,051	1.122	3,464	11.406	.733	37.04	37.04	1.96			
4th "	163,144	.730	2,061	19.42	.493	33.40	33.31	1.52			
YEAR	291,916	.908	6,570	15.42	.572	38.20	37.67	1.71			
1916											
1st Quarter	206,621	.833	3,259	21.96	.498	40.80	40.80	1.40			
2d "	410,213	.748	5.162	26.45	.422	44.49	44.49	.84			
3d "	452,574	.752	6,632	25.28	.387	49.23	49.02	.76			
4th "	557,764	.755	7,888	24.44	.416	45.73	45.67	.72			
YEAR	1,627,172	.762	22,921	24.71	.419	45.64	45.64	.85			
1917											
Jan. 17 & 18	1,803	.813	24	27.31	.465	43.56	43.55	20.30			
Feb. 8 to 28	7.597	.668	188	12.22	.375	45.25	45.25	20.10	1.029	3.65	——
Mar. 1st to 14th, Inclusive	4,549	.653	104	10.25	.439	34.31	34.24	20.54			
Mar. 15th to 17th, Inclusive	2,000	.725	69	7.60	.568	24.36	23.40	24.31			
Mar. 20th to 26th, Inclusive	6,660	.731	521	17.97	.606	17.74	17.69	21.34			

NOTE:

Results from Feb. 8th to Mar. 14th were obtained when using coal tar oil mixtures on Air Machine. The construction of this machine is such that only one cleaning can be obtained. This corresponding product, on our large installation receives a double, or two recleanings, thus raising the grade of concentrate to 25.00% Cu. Our corresponding primary concentrate when using less than 1 pound of oil per ton material treated will average 12.00% Cu. The results on January 17th and 18th were obtained when using straight Coal Tar, those on March 15th to 17th, inclusive were using Smelter fuel oil and Barrett No. 4 oil, while those on March 20th to 26th inclusive were obtained when using Floteo No. 20 and No. 21 oil with small amounts of Pine oil. The results on January 17th and 18th and March 15th to 17th and March 20th to 26th were obtained at No. 1 Pyramid as a Roughing Machine followed by the Air Machine as cleaners, thus giving the rougher concentrate a double recleaning. This flow sheet is similar to our installation when operating with less than 1 pound of oil per ton.

Hayden, Mar. 29th, 1917,

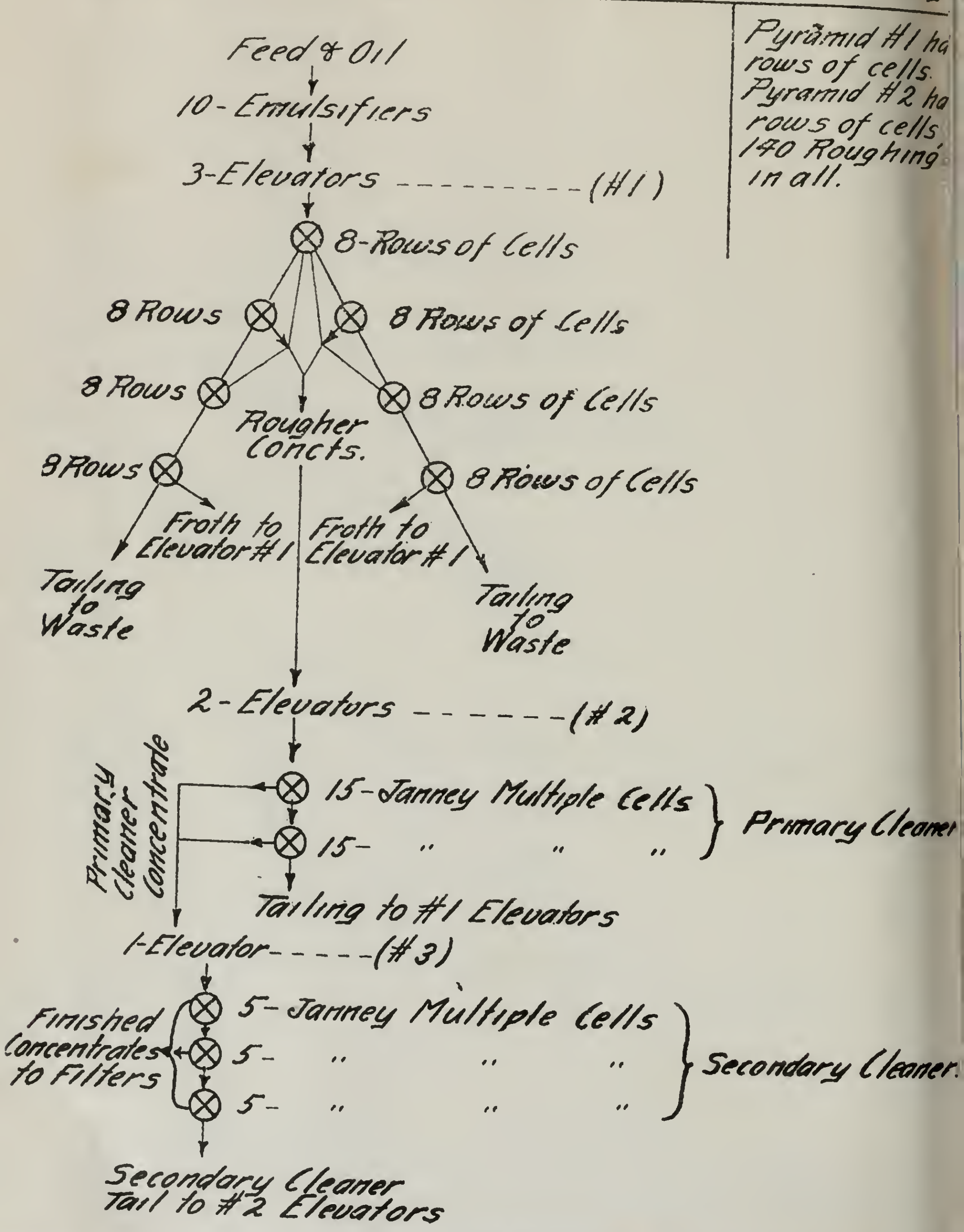
(Signed) E. W. ENGELMANN,
Flotation Foreman.

Copied Butte, Apr. 23, 1917.

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Defendant's Exhibit No. 152.

JANNEY MECHANICAL AIR CELLS
On Pyramid Installation Treating Slime Vanner Tailing



Filed May 18, 1917. GEO. W. SPROULE, Clerk
By H. H. WALKER, Deputy

Defendant's Exhibit No. 153.

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Defendant's E

RAY CONSOLIDATE
Hayden
COMPARATIVE RESULTS OBTAINED ON AIR MACHINE
MORE THAN 1% OF OIL PER TON AND AI
SAME OIL MIXTU

DATE	Product Treated	Kind of Oil	Original Lbs. Oil Per Ton
Mar. 30, 31 and April 1	Retreating Plant Feed	90% Fuel and 10% Barrett No. 4	22.24
April 3d, 4th and 5th	Retreating	90% Fuel and 10% Barrett No. 4	11.27
Mar. 30th, 31st and Apr. 1st	Slime Vanner Tailing	Straight Coal Tar	22.41
Apr. 3d, 4th and 5th	Slime Vanner Tailing	Straight Coal Tar	11.20
RESULTS OBTAINED WHEN ELIMINAT			
Apr. 7th	Retreating Plant Feed	Straight Barrett No. 4	2.39
Apr. 8th	Retreating Plant Feed	Straight Barrett No. 4	1.31
Apr. 7th	Slime Vanner Tailing	Straight Barrett No. 4	2.07
Apr. 8th	Slime Vanner Tailing	Straight Barrett No. 4	1.13

NOTE—The oils used on retreating machine were as indicated above. The only variation from oil mixtures indicated was an o
This pine was never used continuously and was of so minnte a quantity that the operator failed to record same. This practice, l
NOTE 2—

Pine oil is never used in this manner on machines treating our flotation slime feed.

When using straight Barrett No. 4, the bubble is brittle and somewhat delicate and has a tendency to burst when coming to the
carrying oil, but the latter characteristic is not sufficient to strengthen the bubble enough to carry the larger mineral particles, espe

When using mixtures of Barrett No. 4 and Fuel Oil, the latter has the faculty of strengthening the creosote bubble sufficient
Hayden, Ariz., Apr. 9th, 1917.
Copied Butte Apr. 23d.

xhibit No. 154.

:D COPPER COMPANY
ı Plant
:S AND RETREATING MACHINES WHEN CONSUMING
,SO ½ OF 1% OIL PER TON, USING THE
'RE THROUGHOUT.

HEADING		CONCENTRATE		Tails Assay % Cu.	Indicated Extraction %	% Solids	Pounds Oil per Ton Heads Incl. Cir. L.	PERCENT OIL	
Tonnage	Assay % Cu.	Tonnage	Assay % Cu.					Concts.	Tails
1125	6.14	309	21.48	.326	96.14	23.60	20.90	3.25	.035
1133	6.24	321	21.28	.290	96.67	22.23	10.80	1.82	.022
795	.687	33	7.75	.375	47.63	24.19	22.83		
772	.660	22	10.64	.366	46.15	25.81	10.95	3.95	.445
'ING FUEL OIL FROM OIL MIXTURES									
344	6.30	63	29.56	1.083	85.95	20.47			
356	6.20	54	34.16	1.25	82.89	20.35			
245	.676	4	12.56	.456	33.65	26.63			
273	.720	3	18.13	.543	25.39	27.81			

:casional addition of a small amount of pine oil when an unusual amount of coarse feed entered the machine.
ıowever, was maintained throughout entire tests regardless of amount of original oil mixture added at head of machine.

surface, thus causing the coarse mineral particles to drop. This oil is a very good frothing agent and also acts somewhat as a
:ially when acting in feeds carrying large percentages of mineral.
to carry mineral particles which would ordinarily drop if using straight Barrett No. 4.

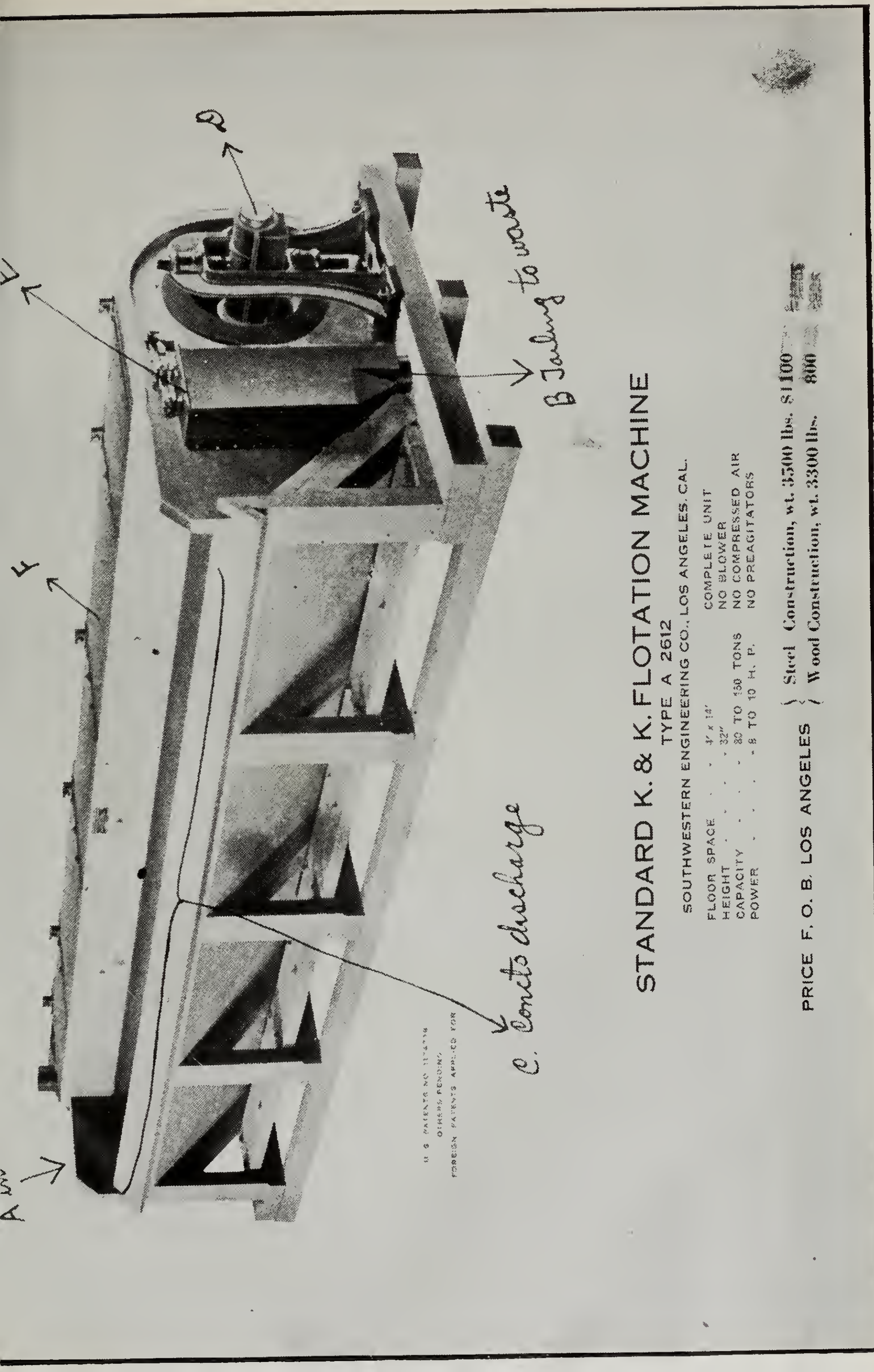
(Signed) E. W. ENGLEMANN
Flotation Foreman

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Defendant's Exhibit No. 155.

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Defendant's Exhibit No. 156.



Filed May 18, 1917. GEO. W. SPROULE, Clerk. By H. H. WALKER, Deputy.

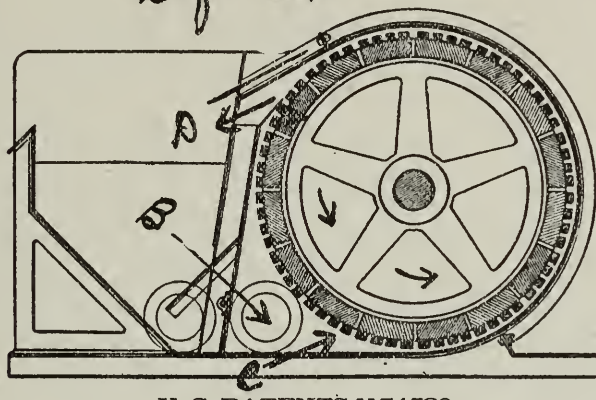
Defendant's Exhibit No. 157.

(Page One)

THE K & K FLOTATION MACHINE

— BULLETIN NO. 1 —

Def. Ex 157



U. S. PATENTS 1174739

OTHERS PENDING

Foreign Patents Applied for.

SOUTHWESTERN ENGINEERING CO.,

Consulting Mining, Metallurgical, Mechanical and Electrical Engineers.

523-524 Wesley Roberts Building,
LOS ANGELES, CALIFORNIA.

Mine Examination
Ore Treatment Problems
Ore Testing Laboratory
Concentration and Flotation Tests

Defendant's Exhibit No. 157.

(Page Two)

D. D. BISBEE Elect., & Mech., Engineer
L. C. Penhoel, Mining Engineer
Max Kraut, Metallurgical Engineer

(Page Three)

DESCRIPTION.

The Machine consists essentially of a long, hollow, cylindrical drum, mounted on a horizontal shaft. This drum is provided with a series of longitudinal air slots and a larger number of longitudinal riffles running the entire length of the drum. The drum is rotated rapidly inside of a close fitting casing and the whole enclosed in a suitable housing as shown in the accompanying illustration. A discharge lip placed tangentially to the periphery of the drum provides for taking the pulp into the frothing box and a controllable intake passage at the bottom of the frothing box provides for returning the pulp to the aeration chamber for retreatment.

OPERATION.

The machine is very simple, having automatic tailings discharge and level control. One man can take care of any number of machines.

ADAPTABILITY

Machine can be run in the ordinary flow sheet in flotation work, or else can be run as an independent unit adding the oil directly to the machine.

LABOR AND CARE.

The machine is self regulating and requires no attention outside of keeping the bearings oiled properly.

Defendant's Exhibit No. 157.

(Page Four)

SOME SUPERIOR POINTS.

1. Large capacity in a comparatively small floor space.
2. Little head room required.
3. Simplicity of construction.
4. Automatic control of machine, requiring little or no attention.
5. Low power consumption, due to the fact that churning and agitation are avoided, and air taken in at atmospheric pressure by suction.
6. Only wearing parts are riffles, which when worn out can be readily replaced.
7. Sands do not interfere with working of machine.
8. Settling of sands in frothing box and choking of machine is impossible.
9. With some ores machine can be operated as an independent unit, the oil being fed directly into machine.
10. Machine has no stuffing boxes and therefore no friction losses except in bearings.

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Defendant's

BUTTE AND SUPER

FLOTATION

PERIOD	Flot. Plant Feed — Ore to Flot. Plant — Dry Tons	Flot. Plant Feed — Ore to Flot. Plant — Per Cent Zinc	Flotation Machine Feed (Ore to Flot. Plant plus Circulating Middling Treated in Flotation) — Per Cent Zinc	Flot. Concts. — Dry Tons	Flot. Concts. — Per Cent Zinc	Fl. Tail — Per Zi
1913						
1st quarter	47,555	16.43		11,089	45.76	7.4
2nd quarter	49,698	15.28		13,811	46.09	3.0
3rd quarter	72,935	15.42		19,871	48.19	2.8
4th quarter	85,939	14.05		20,836	49.63	2.7
Year	256,127	15.14		65,607	47.80	4.0
1914	287,247	14.14		64,420	53.03	2.5
1915	471,478	13.66		107,348	54.82	1.7
1916						
3rd quarter	126,417	12.89		28,882	53.92	1.0
Year	583,937	13.36		133,785	53.83	1.2
Dec. 22, 1916-						
Jan. 7, 1917	23,901	12.64		5,222	51.72	1.4
Jan. 9-16	14,651	12.87		2,680	48.22	4.1
Jan. 17-29	19,158	13.48		4,587	47.68	2.1
Jan. 30-Feb. 3	8,863	12.36		2,211	49.06	1.6
Jan. 7-Feb. 6	47,852	12.99		10,546	48.45	2.7
Feb. 4-28	36,262	13.29	20.25	8,556	46.69	1.9
Mar. 1-20	30,231	12.72	22.70	7,194	47.50	1.5
Mar. 21-31	17,142	12.55	29.18	3,651	47.40	2.8
Apr. 1-15	24,298	13.09	22.42	5,852	46.32	2.3

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

No. 158.

COMPANY

IS

Zinc Recovery	Acid	OIL—AMOUNT AND ANALYSIS					
		Per Ton Ore to Flotation		Per Cent Oil in Ore and Circulating Middling Treated in Flotation	Pounds Oil Per Ton Contained in Ore & Circulating Middling Treated in Flot.	Per Cent Oil in Concs.	Per Cent Oil in Tailings
Estimated	Pounds Per Ton	Pounds Added	Per Cent Added				
64.56	1.68	4.76	0.24				
83.86	3.41	9.82	0.49				
85.16	7.05	4.14	0.20				
85.62	8.45	4.78	0.24				
80.87	5.60	5.58	0.28				
84.12	12.00	2.22	0.11				
90.36	7.81	1.49	0.07				
92.73	5.38	1.67	0.08				
92.33	5.25	1.43	0.07				
89.50	3.16	3.06	0.15				
68.60	20.55	24.90	1.24				
84.70	13.41	16.75	0.84				
99.20	11.65	16.05	0.80				
82.30	14.70	20.23	1.01				
82.86	10.29	20.07	1.00	1.27	25.40	1.86	0.55
88.87	9.81	21.30	1.06	1.50	30.00	2.29	0.69
80.46	10.15	22.86	1.14	1.56	31.20	2.45	0.71
85.21	9.98	23.91	1.19	1.34	26.80	2.09	0.70

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BUTTE A

FLOTATION PLANT R

DATE	Flotation Plant Feed: Dry Tons	Flotation Plant Feed: Per Cent Zinc	Flotation Machine Feed (Ore to Flot. Plant plus Circulating Midding Treated in Flotation) Per Cent Zinc	Flot. Concentrates: Dry Tons	Flot. Concentrates: Per Cent Zinc	
Jan. 9	1,837	11.62	21.40	163	51.80	
Jan. 10	1,690	13.46	20.90	262	50.90	
Jan. 11	953	12.20	19.10	180	44.20	
Jan. 12	1,564	11.16	25.20	244	46.80	
Jan. 13	1,288	13.12	22.90	279	47.30	
Jan. 14	1,065	13.27	18.40	269	45.40	
Jan. 15	1,502	12.72	21.20	319	45.50	
Jan. 16	1,381	11.60	21.30	303	44.30	
Jan. 17	1,352	12.72	19.30	311	47.00	
Jan. 18	1,468	13.02	17.60	336	48.10	
Jan. 19	1,397	14.73	14.70	360	50.20	
Jan. 20	1,525	14.26	16.70	403	49.50	
Jan. 21	1,537	14.47	15.80	428	45.60	
Jan. 22	1,600	14.26	16.90	465	43.60	
Jan. 23	1,579	13.90	16.00	384	47.50	
Jan. 24	1,667	13.28	20.00	365	49.10	
Jan. 25	1,591	13.70	22.10	305	51.20	
Jan. 26	267	10.80	22.20	37	46.50	
Jan. 27	1,786	12.45	17.00	389	46.70	1
Jan. 28	1,868	12.69	14.20	435	45.90	1
Jan. 29	1,492	13.14	14.20	369	47.40	1
Jan. 30	1,525	10.42	15.30	317	48.00	1
Jan. 31	1,841	12.37	19.40	594	50.10	1
Jan. 9-31	33,775	12.91	18.77	7,517	47.52	26

W.A.S.
T.F.S.
J.B.K.
D.C.H.
B.H.D. 2
J.L.B.

April 14th, 1917.

Filed May 18, 19[illegible]

GEO. W. SPROULE. Clerk.
By H. H. WALKER. Deputy.

b No. 159.

NING COMPANY

JANUARY, 1917

Flot. Zinc Recovery		OIL—AMOUNTS AND ANALYSIS						
		Per Ton Ore to Flotation						
pparent	Estimated	Pounds Added	Per Cent Added	Per Cent Oil in ore and Circulating Middling Treated in Flotation	Pounds Oil per Ton Contained in Ore & Circulating Middling Treated in Flotation	Per Cent Oil in Flotation Conc.	Per Cent Oil in Flotation Tailing	Oil Used No.
44.63	39.57	10.80	0.540	2.63	52.60	1.46	1.80	1
59.64	58.61	16.25	0.812	2.47	49.40	1.88	2.28	2
75.04	68.42	10.95	0.548	3.28	65.60	1.40	3.45	3
67.36	65.44	16.82	0.841	0.66	13.20	1.95	2.57	4
83.60	78.08	16.09	0.804	1.31	26.20	1.53	0.98	5
89.48	86.43	22.55	1.128	1.92	38.40	2.44	1.37	6
81.48	75.97	16.71	0.835	1.19	23.80	1.36	0.97	7
83.85	83.77	21.09	1.054	1.26	25.20	1.92	0.85	8
88.65	84.96	12.46	0.623	1.32	26.40	1.09	1.49	9
87.39	84.58	13.83	0.697	2.43	48.60	1.63	1.16	10
94.30	87.75	16.68	0.834	1.72	34.40	1.77	1.20	11
92.75	91.73	13.10	0.655	1.34	26.80	1.87	1.09	12
92.32	87.73	9.98	0.499	1.30	26.00	2.22	1.10	13
92.51	88.87	15.45	0.773	1.62	32.40	1.90	1.16	14
85.31	83.11	18.29	0.914	1.29	25.80	0.91	1.57	14
83.25	80.93	16.58	0.829	2.56	51.20	3.26	2.39	15
74.58	71.63	18.32	0.916	1.89	37.80	2.43	1.79	16
65.45	59.64	11.27	0.563	2.32	46.40	1.81	1.43	17
87.49	81.73	11.93	0.597	2.11	42.20	2.14	1.94	18
93.57	84.20	15.01	0.750	1.33	26.60	1.91	1.17	18
94.09	89.18	8.06	0.403	1.36	27.20	1.61	1.87	18
90.67	95.80	14.02	0.701	0.56	11.20	1.08	0.25	18
87.12	130.70	12.63	0.632	0.60	12.00	1.41	0.26	18
83.02	81.92	14.75	0.738	1.67	33.40	1.40	1.49	

Defendant's Exhibit No. 160.

BUTTE AND SUPERIOR MINING COMPANY

Below is a statement of the percentages of oils in the various mixtures used in the flotation plant during the months of January, February and March, as well as April.

No.	Kerosene	Jones Crude	No. 1 Creosote	No. 2 Creosote	Fuel	Pine	No. 4 Barrett	Tar	Paraffine Base
1	60%	%	15%	25%	%	%	%	%	%
2	67		3	29		1			
3			83	10		7			
4	61	2	34			1		2	
5	78		4	18					
6	70	3		27					
7	72		3	20		3	2		
8	74					14	12		
9	75					20	5		
10	55	7		2		34	1		
11	38	40				18	4		
12	64	30	1	2					3
13	60	14				11			15
14	31	59				10			
15	42	46				12			
16	28	62	1			9			
17	40	51		1		8			
18	21	69				10			
19	25	18	49			8			
20	27	7	60			6			
21	28	24	12	36					
22	47	8		4	31	10			
23					84	16			
24					95	5			
25	17				71	12			
26	10				85	5			
27	23	72				5			
28	10	70				20			
29	2				92	6			
30	10				80	10			
31	10				75	15			
32	8	45			31	16			
33		41			48	11			
34	22	39			24	15			
35	13	2			61	24			
36	35				50	15			
37	20				65	15			
38					80	20			
39	15				65	20			
40	15				75	10			
41	5	75			10	10			
42	10	55			15	20			
43	10	50			20	20			
44	10	10			65	15			
45	10				75	15			
46	5		15		70	10			
47	5		35		50	10			
48	10		10		70	10			
49	20				70	10			
50	18		2		70	10			
51	9	32	3		38	18			
52	10	70			5	15			
53	10	40			40	10			

April 19th, 1917.

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Defenda

BUTTE AND S

FLOTATION PLANT RECORI

DATE	Flotation Plant Feed Dry Tons	Flotation Plant Feed Per Cent Zinc	Flotation Machine Feed (Ore to Flot. Plant plus Circulating Midding Treated in Flotation) Per Cent Zinc	Flot. Concentrates Dry Tons	Flot. Concentrates Per Cent Zinc	Dry Tons
Feb. 1	1,863	12.114	18.90	401	50.20	1,462
Feb. 2	1,608	13.465	15.30	413	49.00	1,195
Feb. 3	1,981	14.150	17.40	486	48.00	1,495
Feb. 4	1,843	11.750	18.50	356	50.70	1,486
Feb. 5	1,628	13.296	18.50	373	50.20	1,255
Feb. 6	1,709	12.795	20.80	359	51.20	1,350
Feb. 7	1,705	12.559	20.20	337	50.90	1,368
Feb. 8	1,768	12.712	20.20	320	51.30	1,448
Feb. 9	1,562	13.384	20.30	319	52.30	1,243
Feb. 10	1,175	14.270	24.30	282	51.40	893
Feb. 11	530	11.825	15.40	125	47.20	405
Feb. 12	1,430	13.191	19.50	321	49.20	1,109
Feb. 13	1,454	11.763	24.10	236	50.70	1,218
Feb. 14	1,373	11.404	24.50	255	51.70	1,118
Feb. 15	1,535	12.771	20.90	324	47.70	1,211
Feb. 16	1,455	10,557	21.00	276	46.80	1,179
Feb. 17	1,478	12.778	22.00	322	49.40	1,156
Feb. 18	1,470	13.900	18.80	370	44.40	1,100
Feb. 19	1,448	12.462	18.00	333	44.80	1,115
Feb. 20	1,552	12,954	15.50	426	46.50	1,126
Feb. 21	1,779	13.985	19.00	490	47.00	1,289
Feb. 22	1,756	13.687	20.90	398	51.30	1,358
Feb. 23	1,658	15.350	22.00	412	51.70	1,246
Feb. 24	1,769	14.312	24.40	454	48.60	1,315
Feb. 25	1,353	13.398	18.10	385	43.60	968
Feb. 26	1,662	14,043	17.10	489	43.20	1,173
Feb. 27	1,219	15,780	19.00	428	41.30	791
Feb. 28	1,794	14.645	21.50	522	43.90	1,272
Month	43,557	13.190	19.70	10,212	48.10	33,344

W.A.S.
T.F.S.
J.B.K.
D.C.J.
J.L.B.
B.H.D. 2 April 4, 1917.

N 161.

COMPANY

FEBRUARY, 1917

Fl Zinc Rcovery Estimated	Per Ton Ore to Flotation: Pounds Added	Per Ton Ore to Flotation: Per Cent Added	Per Cent Oil in Ore and Circulating Middling Treated in Flotation	Pounds Oil per Ton Contained in Ore & Circulating Middling Treated in Flotation	Per Cent Oil in Flotation Conc.	Per Cent Oil in Flotation Tailing	Oil Used No.
89.20	10.77	0.539	0.64	12.80	1.45	0.30	18
93.46	13.94	0.697	0.70	14.00	1.34	0.31	18
87.64	17.78	0.889	0.73	14.60	1.36	0.47	19
83.38	19.83	0.992	0.74	14.80	1.12	0.42	20
86.50	20.99	1.050	0.79	15.80	1.12	0.46	19
84.06	24.31	1.215	0.78	15.60	1.04	0.69	19
80.11	19.03	0.952	0.76	15.20	1.34	0.50	19
73.04	16.86	0.843	0.79	15.80	1.10	0.55	21
79.80	19.65	0.983	0.75	15.00	1.53	0.43	22
86.45	20.75	1.038	1.08	21.60	2.10	0.54	23
94.14	15.34	0.767	0.85	17.00	1.59	0.30	24
83.73	16.24	0.812	1.14	22.80	2.31	0.52	24
69.96	19.62	0.981	1.36	27.20	2.66	0.73	25
84.20	13.93	0.696	1.12	22.40	2.49	0.47	26
78.83	16.57	0.829	0.99	19.80	2.24	0.42	26
84.09	24.86	1.243	1.27	25.40	1.94	0.56	27
84.22	22.05	1.102	1.24	24.80	1.95	0.71	27
80.40	21.80	1.090	1.74	34.80	1.94	0.60	27
82.71	21.40	1.070	2.02	40.40	2.02	0.66	27
98.53	21.56	1.078	2.51	50.20	1.93	0.56	28
92.56	17.69	0.885	1.24	24.80	1.87	0.59	28
84.95	20.22	1.011	2.85	57.00	2.29	0.54	29
83.69	14.97	0.749	1.35	27.00	2.47	0.59	30
87.15	24.13	1.207	1.05	21.00	2.08	0.46	31
92.60	22.41	1.120	1.13	22.60	1.66	0.44	32
90.51	24.17	1.209	1.17	23.40	1.69	0.45	32
91.90	20.85	1.042	1.14	22.80	1.61	0.62	33
87.22	19.30	0.905	1.26	25.20	1.90	0.68	34
85.49	19.33	0.967	1.18	23.60	1.77	0.52	

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Defendan

BUTTE AND SU
FLOTATION PLANT RECORD

DATE	Flotation Plant Feed Dry Tons	Flotation Plant Feed Per Cent Zinc	Flotation Machine Feed (Ore to Flot. Plant plus Circulating Middling Treated in Flotation) Per Cent Zinc	Flot. Concentrates Dry Tons	Flot. Concentrates Per Cent Zinc	Flot. Tailings Dry Tons	Flot. Tailings Per Cent Z
Mar. 1	1 628	14.48	21.60	479	45.40	1 148	1
2	1 781	15.02	24.50	512	47.30	1 269	1
3	1 478	13.15	25.70	346	48.60	1 152	1
4	1 521	12.94	21.30	372	47.30	1 149	1
5	1 523	12.52	23.90	342	50.50	1 181	1
6	1 510	13.18	24.10	375	48.30	1 135	1.
7	1 457	13.25	20.40	377	45.20	1 082	1.
8	1 281	11.90	21.70	297	46.70	984	1.
9	1 453	12.18	20.50	331	47.00	1 122	1.
10	1 541	13.32	21.40	394	46.20	1 147	1.
11	1 421	11.84	21.40	307	48.60	1 114	1.
12	1 321	12.20	27.20	267	51.50	954	2.
13	1 445	13.60	29.20	327	51.10	1 118	2.
14	1 557	13.30	30.00	344	49.30	1 213	2.
15	1 703	11.85	22.50	363	47.40	1 340	1.
16	1 857	11.04	19.80	405	47.00	1 452	1.
17	1 623	12.31	20.00	392	45.10	1 231	1.
18	1 105	11.99	15.70	269	46.40	836	1.
19	1 477	12.15	18.90	363	44.00	1 114	1.
20	1 549	11.80	24.30	332	47.20	1 217	1.
21	1 473	13.84	23.30	365	47.60	1 108	2.
22	1 598	11.82	25.80	228	44.90	1 370	6.
23	1 476	13.56	19.80	406	41.30	1 070	2.
24	1 549	12.78	22.00	345	45.10	1 204	3.
25	1 470	12.25	22.00	346	44.30	1 124	2.
26	1 451	12.24	29.00	319	48.00	1 132	2.
27	1 421	12.52	30.00	300	50.00	1 121	1.
28	1 557	13.41	32.70	360	50.60	1 197	2.
29	1 706	11.83	29.80	335	50.30	1 371	2.1
30	1 667	12.16	27.70	324	49.50	1 343	2.6
31	1 774	11.89	29.70	323	50.70	1 451	3.1
Month	47 373	12.66	23.42	10 845	47.30	36 449	2.0

W.A.S.
T.F.S.
J.B.K.
D.C.J.
B.H.D.
J.L.B.

April 14th, 1917.

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

o. 162.

G COMPANY

MARCH, 1917

OIL—AMOUNT AND ANALYSIS

	Per Ton Ore to Flotation			circulating			
ted	Pounds Added	Per Cent Added	Per Cent Oil in Ore and Circulating Middling Treated in Flotation	Pounds Oil per Ton Contained in Ore & Middling Treated in Flot.	Per Cent Oil in Flotation Conc.	Per Cent Oil in Flotation Tailing	Oil Used No.
26	19.76	0.99	1.17	23.40	1.64	0.62	35
56	29.44	1.47	2.76	55.20	2.71	0.68	36
51	21.66	1.08	1.23	24.60	2.28	0.61	37
42	17.52	0.87	1.28	25.60	2.01	0.57	38
61	23.42	1.17	1.28	25.60	1.98	0.62	39
04	18.72	0.94	1.30	26.00	2.11	0.54	40
24	25.28	1.26	1.15	23.00	1.97	0.50	40
99	20.00	1.00	1.29	25.80	2.14	0.63	40
94	21.90	1.09	1.44	28.80	2.34	0.74	40
66	20.83	1.04	1.88	37.60	2.86	0.69	40
66	22.57	1.13	1.52	30.40	2.64	0.58	40
31	20.09	1.00	1.20	24.00	2.45	0.66	40
03	19.20	0.96	1.62	32.40	2.55	0.65	40
62	24.23	1.21	1.45	29.00	2.66	0.53	40
78	21.73	1.08	1.59	31.80	2.52	0.63	41
80	20.73	1.04	1.35	27.00	2.22	0.74	42
51	18.81	0.94	1.48	29.60	1.92	0.87	43
22	25.71	1.28	1.91	38.20	1.66	1.16	42
02	21.26	1.06	1.55	31.00	2.40	1.01	44
73	19.62	0.98	1.47	29.40	2.71	0.91	45
21	23.74	1.19	1.72	34.40	2.94	1.15	45
19	23.59	1.17	1.77	35.40	2.93	0.76	46
78	22.11	1.10	1.85	37.00	3.09	0.55	47
58	23.59	1.18	1.47	29.40	2.64	0.69	48
14	21.56	1.08	1.41	28.20	2.48	0.77	49
20	21.94	1.09	1.49	29.80	2.83	0.67	49
30	23.54	1.18	1.55	31.00	2.64	0.67	49
23	22.85	1.14	1.38	27.60	2.61	0.76	49
50	24.97	1.25	1.41	28.20	2.41	0.58	50
09	21.66	1.08	1.35	27.00	2.43	0.71	50
63	21.86	1.09	1.71	34.20	3.36	0.80	50
60	22.08	1.10	1.52	30.40	2.45	0.71	

Defend

BUTTE & S

FLOTATI

Date	Machine No.	MACHINE FEED — Ore To Machines — Dry Tons	MACHINE FEED — Ore To Machines — % Zinc	Concentrates — % Zinc	Tailings — % Zinc	% Rec Ap
12/29/1916	2	178	14.00	46.00	2.32	87
12/30/1916	1	108	13.20	47.60	1.35	92
12/30/1916	2	117	13.30	45.40	0.96	94
12/31/1916	1	160	12.20	46.20	2.38	84
12/31/1916	2	115	11.00	45.40	1.10	92
1/1/1917	1	153	11.10	42.90	0.99	93.
1/1/1917	2	93	12.80	44.60	0.50	97.
1/1/1917	8	76	13.10	42.70	1.51	91.
1/2/1917	1	160	13.80	47.70	2.20	88.
1/2/1917	2	140	14.20	46.50	1.95	90.
1/2/1917	8	210	15.00	43.40	2.96	86.
1/3/1917	1	167	13.10	44.20	1.60	91.
1/3/1917	2	135	15.50	47.80	3.35	84.
1/4/1917	1	117	14.10	44.50	1.44	92.
1/4/1917	2	120	14.80	45.70	2.25	89.
1/5/1917	1	130	11.00	41.90	0.91	93.
1/5/1917	2	162	12.20	42.00	1.40	91.
1/5/1917	8	173	14.40	43.50	2.96	85.
1/6/1917	1	132	9.50	48.80	0.90	92.
1/6/1917	2	213	14.90	48.80	2.21	89.
1/6/1917	8	149	13.90	47.00	1.45	92.4
1/7/1917	1	128	8.40	46.20	0.80	92.0
1/7/1917	2	198	12.40	36.30	1.54	91.4
1/7/1917	8	240	15.70	50.10	1.56	92.9
1/8/1917	1	54	8.10	47.70	0.74	92.3
1/8/1917	2	103	11.70	44.70	1.26	91.8
1/8/1917	8	89	15.10	45.80	1.42	93.4

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

it No. 163.

IG COMPANY

) IACHINES

Ton Ore Machines — Per Cent Added	Per Cent Oil in Ore and Circulating Middling Treated in Machines	Pounds Oil per Ton in Ore and Circulating Middling Treated in Machines	Per Cent Oil in Concentrates	Per Cent Oil in Tailings	Oil Used No.
OIL---AMOUNT AND ANALYSIS					
1.43	No Analysis	....	No Analysis	No Analysis	1 A
1.68	3.32	66.40	2.57	1.10	2 A
1.64	1.84	36.80	2.42	0.86	3 A
1.20	3.27	65.40	2.67	1.77	4 A
1.78	1.24	24.80	1.40	2.26	5 A
1.43	1.54	30.80	2.12	1.11	4 A
2.26	1.01	20.20	3.13	1.11	5 A
3.15	2.94	58.80	2.62	2.72	6 A
1.38	1.59	31.80	1.78	1.49	7 A
1.49	2.66	52.20	1.84	2.47	5 A
1.10	1.94	38.80	1.53	1.75	8 A
1.60	2.89	57.80	1.61	0.35	9 A
1.23	2.37	47.40	1.38	1.30	10 A
2.06	1.79	35.80	2.17	1.60	11 A
1.70	2.50	50.00	1.34	0.82	5 A
1.25	2.62	52.40	1.56	2.17	12 A
1.22	1.31	26.20	2.39	0.91	5 A
1.16	3.24	64.80	2.17	0.94	13 A
1.84	2.11	42.20	2.08	0.54	14 A
0.97	3.26	65.20	1.47	0.66	5 A
1.37	1.93	38.60	1.87	1.39	13 A
1.71	1.55	31.00	2.56	0.55	14.A
1.12	1.25	25.00	2.12	0.51	15 A
0.81	3.10	62.00	1.40	0.83	16 A
1.78	2.13	42.60	2.19	1.40	14 A
0.65	1.82	36.40	1.66	0.63	14 A
1.09	4.39	87.80	1.24	1.45	14 A

Defendant's Exhibit No. 164.

BUTTE AND SUPERIOR MINING COMPANY

is a statement showing the percentages of oils in the various mixtures used on the three pyarmid machines, while running them on experimental tests.

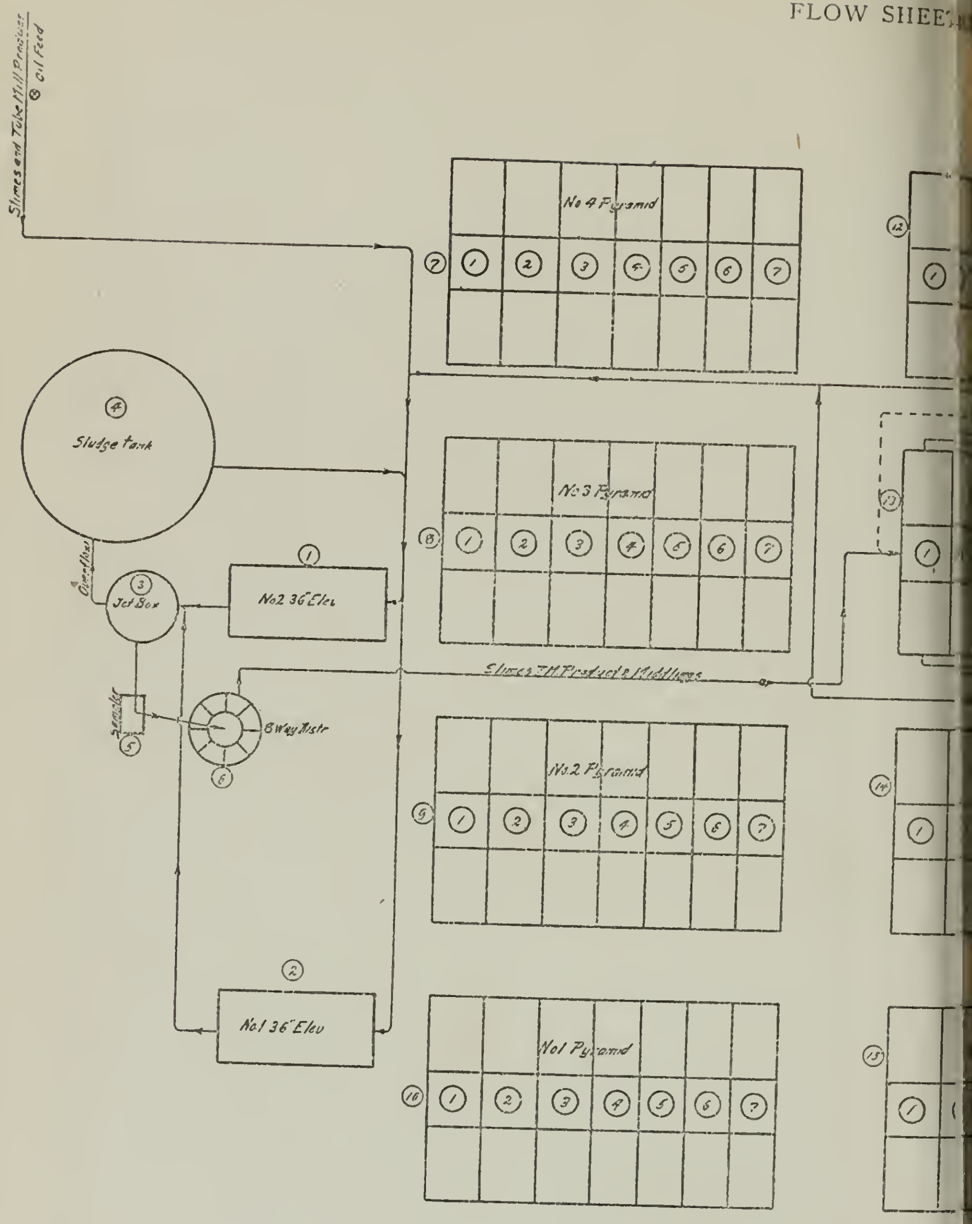
ure	Kerosene	Jones Crude	No. 1 Creosote	No. 2 Creosote	Fuel	Pine	No. 4 Barrett	Tar	Paraffine Base
A	54			46					
A		98				2			
A	82			18					
A	30	70							
A	77			23					
A	67			7				26	
A	30	65		5					
A	77			8				15	
A	22	74		4					
A	91			9					
A		97		3					
A		87				13			
A	85			3				12	
A			100						
A	8		90	2					
A	1		97					2	

Butte, Montana,
April 17, 1917.

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

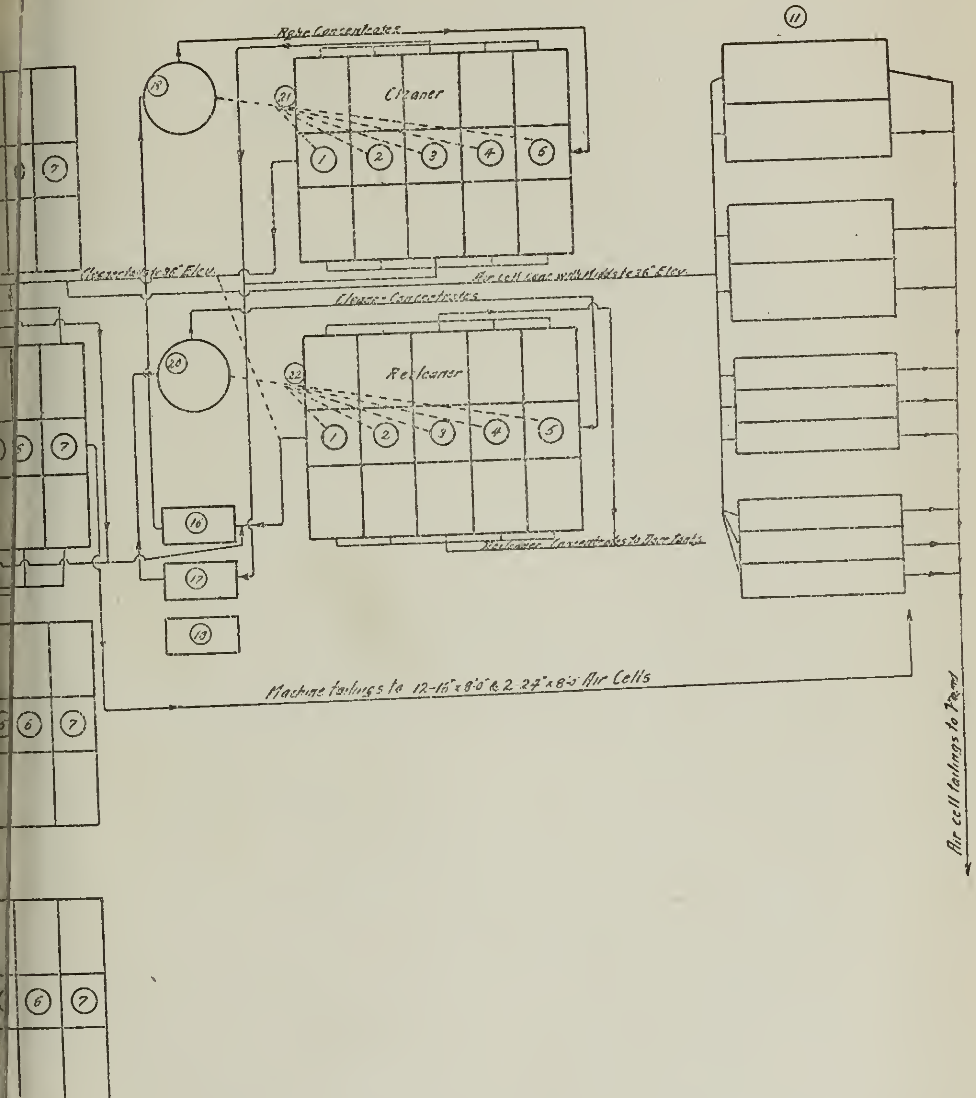
Defend

FLOW SHEE



N. 165.

E OR PLANT



Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Defendant's Exhibit No. 166.

ORIGINAL

BUTTE & SUPERIOR COPPER COMPANY
(Limited)

J. M. Hyde, ... Dr.
Address Basin, Mont.

nse account for July, 1911, @ $5.00 per lay,	155 00	
third payment on Test Machine	10 00	
		165 00

ect:

AJF
Clerk

oved:

W Atwater
Superintendent

Butte, Montana........................191....

Received from BUTTE & SUPERIOR COPPER CO. Ltd., One hundred sixty five and no/100 Dollars in full payment of the above account.

Signature James M. Hyde

$165/00 Per.................................

Please sign original and duplicate and return promptly.

dorsement)

ORIGINAL

Voucher No. 3409
Amount $165.00
Check No. ....
Date Paid ....
To J. M. Hyde.

Month July, 1911.

DISTRIBUTION

Extraordinary Expense $165.00

Filed May 18, 1917.

GEO. W. SPROULE, Clerk.

By H. H. WALKER, Deputy.

Defendant's Exhibit No. 167.

ORIGIN L

BUTTE & SUPERIOR COPPER COMPANY
(Limited)

To J. M. Hyde, ... Dr.
Address Basin, Mont.
Expenses, month of August, 1911.
31 das. @ $5.00 per day, . 15: 0

Correct: AJF Clerk Approved: M W Atwater Superintendent	Butte, Montana.......................... .., 19! Received from BUTTE & SUPERIOR C PER CO. Ltd., one hundred fifty-five & no/100 Dollars in full payment of the at e account. $155.00 Signature James M. Hyde Per.......................... Please sign original and duplicate and ret n promptly.

(Endorsement)

8

ORIGINAL

Voucher No. 3495
Amount $155.00
Check No. 2415
Date Paid 8/8/11
To J. M. Hyde.

Month August, 1911.

DISTRIBUTION

Concentrating $155.00

Filed May 18, 1917.

GEO. W. SPROULE, Clerk
By H. H. WALKER, Deput

Defendant's Exhibit No. 168.

ORIGINAL

BUTTE & SUPERIOR COPPER COMPANY
(Limited)

To J. M. Hyde, ... Dr.
Address Basin, Mont.

First payment on account of Hyde plant installation	150.00

Correct: JF Clerk Approved: I. W. Atwater, Superintendent	Butte, Montana, Sept. 22, 1911. Received from BUTTE & SUPERIOR COPPER CO. Ltd., one hundred fifty and no/100 Dollars in full payment of the above account. $150.00 Signature J. M. Hyde Please sign original and duplicate and return promptly.

(Endorsement)

37

ORIGINAL

Voucher No. 3508
Amount $150.00
Check No. 2444
Date Paid 9/21/'11
To J. M. Hyde.

Month September, 1911

DISTRIBUTION

Basin Concentrator Equipment, 150.00

Filed May 18, 1917.

GEO. W. SPROULE, Clerk.

By H. H. WALKER, Deputy.

Defendant's Exhibit No. 169.

ORIGIN.

BUTTE & SUPERIOR COPPER COMPANY
(Limited)

To J. M. Hyde, ... Dr.
Address Basin, Mont.

Second payment on account of Hyde plant installation	150

Correct:
AJF Clerk

Approved:
M W Atwater
Superintendent

Butte, Montana ....19..
Received from BUTTE & SUPERIOR CO
PER Co. Ltd., one hundred fifty and no/1
Dollars in full payment of the above accou
Signature J. M. Hyde

$150.00

Per..............................

Please sign original and duplicate and retu
promptly.

(Endorsement)

47

ORIGINAL

Voucher No. 35719.
Amount $150.00
Check No. 2460
Date Paid 9/25/'11
To J. M. Hyde

Month Sept., 1911.

DISTRIBUTION

Basin Concentrator Equipment	150.00

Filed May 18, 1917.

GEO. W. SPROULE, Clerk.

By H. H. WALKER, Deputy

Defendant's Exhibit No. 170.

ORIGINAL

BUTTE & SUPERIOR COPPER COMPANY
(Limited)

J. M. Hyde, ... Dr.
Address Basin, Mont.

---

xpense A/C at Basin at $5.00 per day for the month of September, ... $150.00

---

orrect:
AJL Clerk

pproved:
M W Atwater
Superintendent

Butte, Montana, Oct. 26, 1911.
Received from BUTTE & SUPERIOR COPPER CO. Ltd. One hundred fifty & no/100 Dollars in Full payment of the above account.
$150.00
Signature J. M. Hyde
Per..........

Please sign original and duplicate and return promptly.

Endorsement)

68

ORIGINAL

Voucher No. 3584
Amount $150.00
Check No. 2534
Date Paid Oct. 20, 1911.
To J. M. Hyde,
Month, September, 1911.

DISTRIBUTION

Concentrating $150.00

(In pencil)
Get after Scott (Purchasing Dept) get 3/8x1¾ Elev. Bolts
nstead of whatever is ordered
M W Atwater, Hotel Samuels, Wallace, Idaho.
Where are derrick irons? Are they shipped
When Where.
If not shipped cut out pulleys (all)

Filed May 18, 1917.

GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Defendant's Exhibit No. 171.

ORIGINA

BUTTE & SUPERIOR COPPER COMPANY
(Limited)

To J. M. Hyde, ... Dr.
Address Auditorium Annex,

To third payment of Hyde Plant installation	5,000.(

Correct: 6 .... Clerk Approved: M. W. Atwater Superintendent	Butte, Montana, Nov. 9, 1911. Received from BUTTE & SUPERIO COPPER CO. Ltd., Five thousand an no/100 Dollars in full payment of th above account. Signature J. M. Hyde. $5,000.00 Per.............................. Please sign original and duplicate and re turn promptly.

(Endorsement)

ORIGINAL

Voucher No. 3610
Amount $5000.00
Check No. 2553
Date Paid 10/26/'11.
To J. M. Hyde.
Month, Oct., 1911.

DISTRIBUTION

Basin Concentrator Equipment 5000.00

Filed May 18, 1917.

GEO. W. SPROULE, Clerk.

By H. H. WALKER, Deputy.

Defendant's Exhibit No. 172.

ORIGINAL

BUTTE & SUPERIOR COPPER COMPANY
(Limited)

To J. M. Hyde, ... Dr.
Address Basin, Mont.

To expense account for October, 1911.
26 das. @ $5.00 per day 130.00

Correct:

Clerk.

Approved:
M W Atwater,
Superintendent

Butte, Montana, Nov. 9, 1911.
Received from BUTTE & SUPERIOR COPPER CO. Ltd., One hundred thirty and no/100 .... Dollars in full payment of the above account.
$130.00

Signature J. M. Hyde
Per........

Please sign original and duplicate and return promptly.

(Endorsement)

86

ORIGINAL

Voucher No. 3609
Amount $130.00
Check No. 2552
Date Paid 10/26/'11.
To J. M. Hyde.

Month, Oct., 1911.

DISTRIBUTION

Concentrating 130.00

Filed May 18, 1917.

GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Defendant's Exhibit No. 173.

(Page 1)

EXPENSE ACCOUNT

Chicago Trip

J. M. HYDE

Butte to St. Paul (ticket, pullman, etc.)	$ 42.5
Meals on train, porter, etc.	5.7
St. Paul to Chicago	10.5
Carriage in Chicago	4.0
Express charges on Test Machine	8.0
Deposit on motor (to be collected by Scott and deducted from his expense acc't)	20.0
Carriage	3.5
Hotel	27.6
Chicago to Duluth	11.8
Duluth to Butte	37.8
Hotel at Duluth	3.0
Meals, Carriage, etc., Chicago & Train	38.3
Trip to Basin and return	3.8
Meals and incidentals at Butte	4.5
	$230.1

Defendant's Exhibit No. 173

(Page 2)

ORIGINAL

BUTTE & SUPERIOR COPPER COMPANY
(Limited)

To James M. Hyde . . . . Dr.
Address.......................................

Account of expense trip Butte to Chicago and return, as per statement attached	$230.15	$230.15

Correct: AJF Clerk Approved: M. W. Atwater Superintendent	Butte, Montana.................19.... Received from BUTTE & SUPERIOR COPPER CO. Ltd., Two hundred thirty & 15/100 Dollars in Full payment of the above account. $230.15 Signature.............................. Per.............................. Please sign original and duplicate and return promptly.

(Endorsement)

72

ORIGINAL

Voucher No. 3764
Amount $230.15
Check No. 2736
Date Paid Dec. 20, 1911
To James M. Hyde

Month November, 1911

DISTRIBUTION

Extraordinary ex. $230.15

Filed May 18, 1917.

GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Defendant's Exhibit No. 174.

Ent ORIGINAI
J 46

BUTTE & SUPERIOR COPPER COMPANY
(Limited)

To J. M. Hyde . . . . . Dr.
Address Butte, Mont.

Expense Account dated Jan. 31, 1912	$383.65	
" " " Mar. 30, 1912	585.82	
	$969.47	
Less: Advance as Voucher 3998	600.00	
		$369.4

Correct:
C.M.E.
Auditor

Approved:
M.W.A.
Superintendent

Butte, Montana..................19...
Received from BUTTE & SUPERIOI COPPER CO. Ltd., Three Hundred Sixty nine & 47/100 Dollars in Full payment o the above account.
$369.47 Signature James M. Hyde
Per..............................
Please sign original and duplicate and re turn promptly.

(Endorsement)

29

ORIGINAL

Voucher No. 4153
Amount $369.47
Check No. 3153
Date Paid Mar. 30, 1912
To J. M. Hyde
Month March

DISTRIBUTION

Extraordinary Expense $369.47

Filed May 18, 1917.

GEO. W. SPROULE, Clerk.

By H. H. WALKER, Deputy.

Defendant's Exhibit No. 175.

Original

BUTTE & SUPERIOR COPPER COMPANY
(Limited)

o J. M. Hyde Dr.
Address Butte, Montana.

Advance on Expenses	$400.00

ORRECT:
C.M.E.
Auditor

PPROVED:
M. W. A.
Superintendent

Butte, Montana, ... 19....
RECEIVED FROM BUTTE & SUPERIOR COPPER CO., Ltd.,
Four Hundred .... Dollars
in Full payment of the above account.
$400.00.
Signature James M. Hyde
Per.
Please sign original and duplicate and return promptly.

Endorsed on Back.

30

ORIGINAL

Voucher No. 4154
Amount $400.00
Check No. 3154
Date Paid Apr. 17, 1912.
To J. M. Hyde
Month April.

DISTRIBUTION

Accts. Payable $400.00

Filed May 18, 1917.

GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Defendant's Exhibit No. 176.

No. 4550

BUTTE & SUPERIOR COPPER COMPANY
Limited.

Butte, Mont. July 8, 1912.

Pay to the order of J. M. Hyde,..$200.00
Two Hundred and No-100..DOLLARS

BUTTE & SUPERIOR C. CO., LTD
(Signed) C. M. Everett
Special

To the FIRST NATIONAL BANK,
Butte, Mont.

Endorsed on back: "Your endorsement hereon constitutes receipt in full for account as per statement which you have detached from this check."

(Signed) James M. Hyde.

Paid 7-9-12

BUTTE & SUPERIOR COPPER COMPANY. 4550
Limited.

Butte, Mont., July 8, 1912.

VOUCHER

Payable to J. M. Hyde, $200.00
Two Hundred and No-100 ....DOLLARS

Approved for payment
(Signed) C. M. Everett

DETAILS OF VOUCHER 4550

Expense Account 200.00

DISTRIBUTION

Hyde Process Patent Right

No. 4550

Filed May 18, 1917.

GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Defendant's Exhibit No. 177.

BUTTE & SUPERIOR COPPER COMPANY.

Limited

Butte, Montana, Nov. 21, 1912.

lo. 5333

ay to the Order of James M. Hyde, 602,50

ix Hundred Two and 50-100 .... Dollars

BUTTE & SUPERIOR COPPER COMPANY, Ltd.

By C. M. Everett.

o the FIRST NATIONAL BANK Special.

Butte, Montana.

Stamped across face of check: "Paid, Dec. 10, 1912. The First Vational Bank of Butte, Butte, Montana. P."

Endorsed on back: "Your endorsement hereon constitutes receipt in full for account as per statement which you have detached rom this check."

(Signed) James M. Hyde.

I. W. A.

The amount advanced Mr. Hyde is $600.00.

April	17	400.00 on a-c.
July	8	200.00 "
		600.00

PAID.

Paul.

Enter Hyde account for 602.50, balance due on trips to Washington and England. Details on attached statements, and pay at once.

M. W. A.

Defendant's Exhibit No. 177

Paul:

Please check amounts advanced Hyde and return.

M. W. A.

HAYDEN, STONE & CO.,
Bankers
New York-Boston.

New York, October 23, 1912.

JMH-M.

Mr. M. W. Atwater,
Butte & Superior Copper Co.,
Butte, Montana.

My dear Max:

In looking over my records I find that I did not present an account of the expenses of my trip to Washington this Spring; my memory is that you advanced me $400 for expenses for that trip and $200 on the London one, of course, you have a record of this. I enclose herewith an account, also the account of my trip from Butte to London and return to New York.

I have trimmed these expense accounts down so that they do not really represent the total necessary cost of my travels.

I shall probably be in New York for two weeks more as the opposition is rather slow in getting in their evidence, but I hope that by the end of that time everything will be complete in the matter of the present suit

Defendant's Exhibit No. 177

with the exception of the presentation of the case in court, and possibly some consultation between Mr. Scott and myself before the matter comes to trial.

You may address me care of Hayden, Stone & Co., 25 Broad Street, New York City.

Our friends, the enemy, are not at all happy nowadays and I will not be surprised if they make some overtures looking to a withdrawal of the suit. This is what they have done in other cases where they had a much better showing than they had with us.

Hoping that all is well with you and trusting that you will at any time call upon me when you feel that my services are necessary, I remain,

Yours very truly,

(Signed) James M. Hyde.

(Encl.)

EXPENSE ACCOUNT OF JAMES M. HYDE

Trip to Washington on Patent Suit

Leaving Butte—April 17, 1912.

Room for Byrnes at Napton	$ 9.00
Materials	5.00
Gas	1.00
Ticket and Pullman, Butte to Washington	68.65
Taxi and Express	2.50
Meals and Porters	10.75
Hotel in Washington 23 days at $6	138.00

Defendant's Exhibit No. 177.

Telegrams, materials, etc.	18.50
Ticket & Pullman to Butte	68.65
Meals, etc. to Butte	12.00
	$334.05

EXPENSE ACCOUNT OF JAMES M. HYDE
Trip to London on Patent Suit
Leaving Butte—July 18, 1912

Butte to New York, Ticket & Pullman	$ 75.70
Meals and Porter to New York	18.00
Hotel, Taxi, etc. in New York	9.25
Passage to London S-S Geo. Washington	151.00
Steamer Expenses	10.00
London July 21-Sept. 5th, 45 days at $10	460.00
Telegrams, messenger, etc.	24.50
Passage to New York, S-S Minnetonka	110.00
Expenses on Steamer	10.00
	$868.45

BUTTE AND SUPERIOR COPPER COMPANY
Limited

Butte, Mont. Nov. 21, 1912.

VOUCHER

PAYABLE TO James M. Hyde, $602.50
Six Hundred Two and 50-100 ....DOLLARS
Approved for Payment
(Signed) C. M. Everett

Defendant's Exhibit No. 177

DETAILS OF VOUCHER.

Expenses trip to Washington Apr. 17			334.05
" " " London July 18-12			868.45
Total			1,202.50
Less:			
Advance Apr. 17th, 1912	400.00		
" July 8th, 1912,	200.00	600.00	
Net Balance		602.50	602.50

DISTRIBUTION

Account Payable	602.50
General Office	
	No. 5333

Filed May 18, 1917.

GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Defendant's Exhibit No. 178.

BUTTE & SUPERIOR COPPER COMPANY,
Limited

New York Office
25 Broad Street

July 31, 1913.

Mr. J. L. Bruce, Manager,

Butte & Superior Copper Company, Ltd.,
Butte, Montana.
Dear Sir:

I am enclosing herewith copy of a telegram received today from James M. Hyde, which I thought you would be interested in seeing.

Yours very truly,
(Signed) N. B. MacKelvie.

NBM..S
Enclosure.

COPY

Berkeley, California, July 30, 1913.
N. B. MacKelvie:

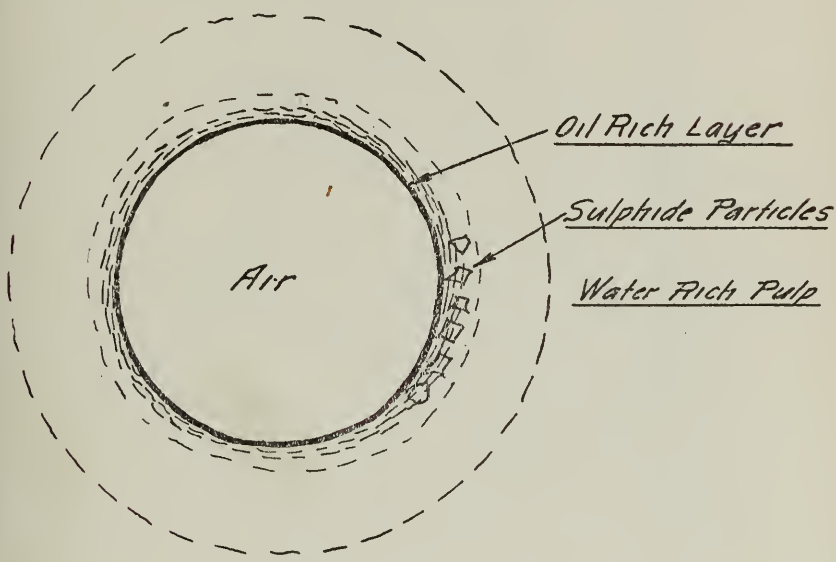
Have received word of decision from Kremer but no details. I take for granted that appeal will be filed. Am at your service for any conferences the occasion may required. Will expect matters under discussion to be held in abeyance until new and unexpected situation is taken care of.

(Signed) James M. Hyde.

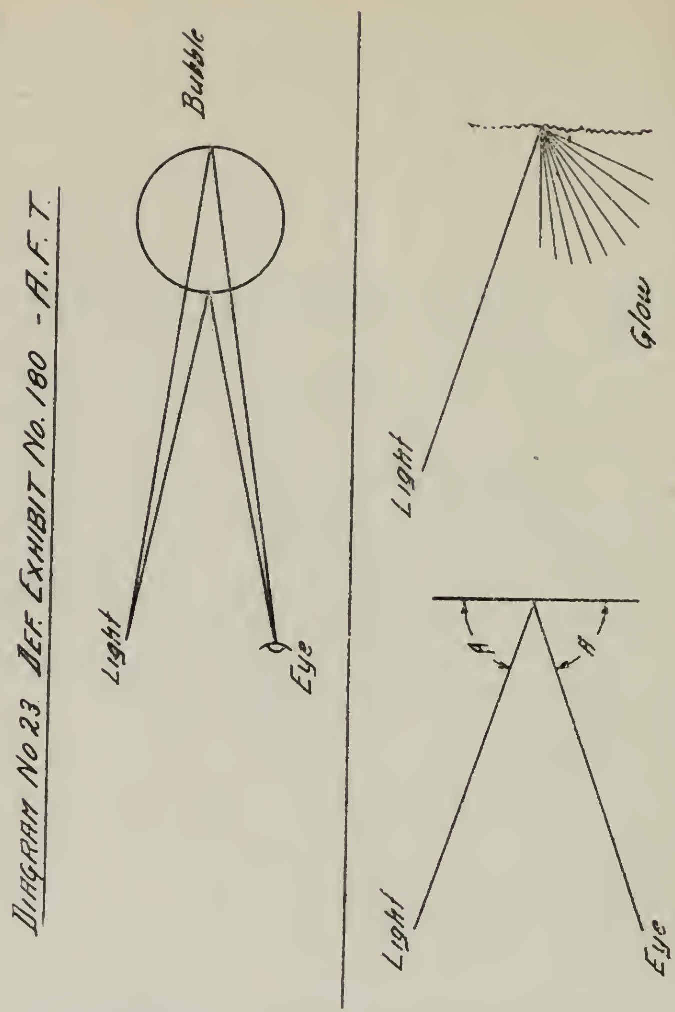
Filed May 18, 1917.

GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

DIAGRAM NO. 22. DEF. EXHIBIT NO. 179 — A.F.T.



Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.



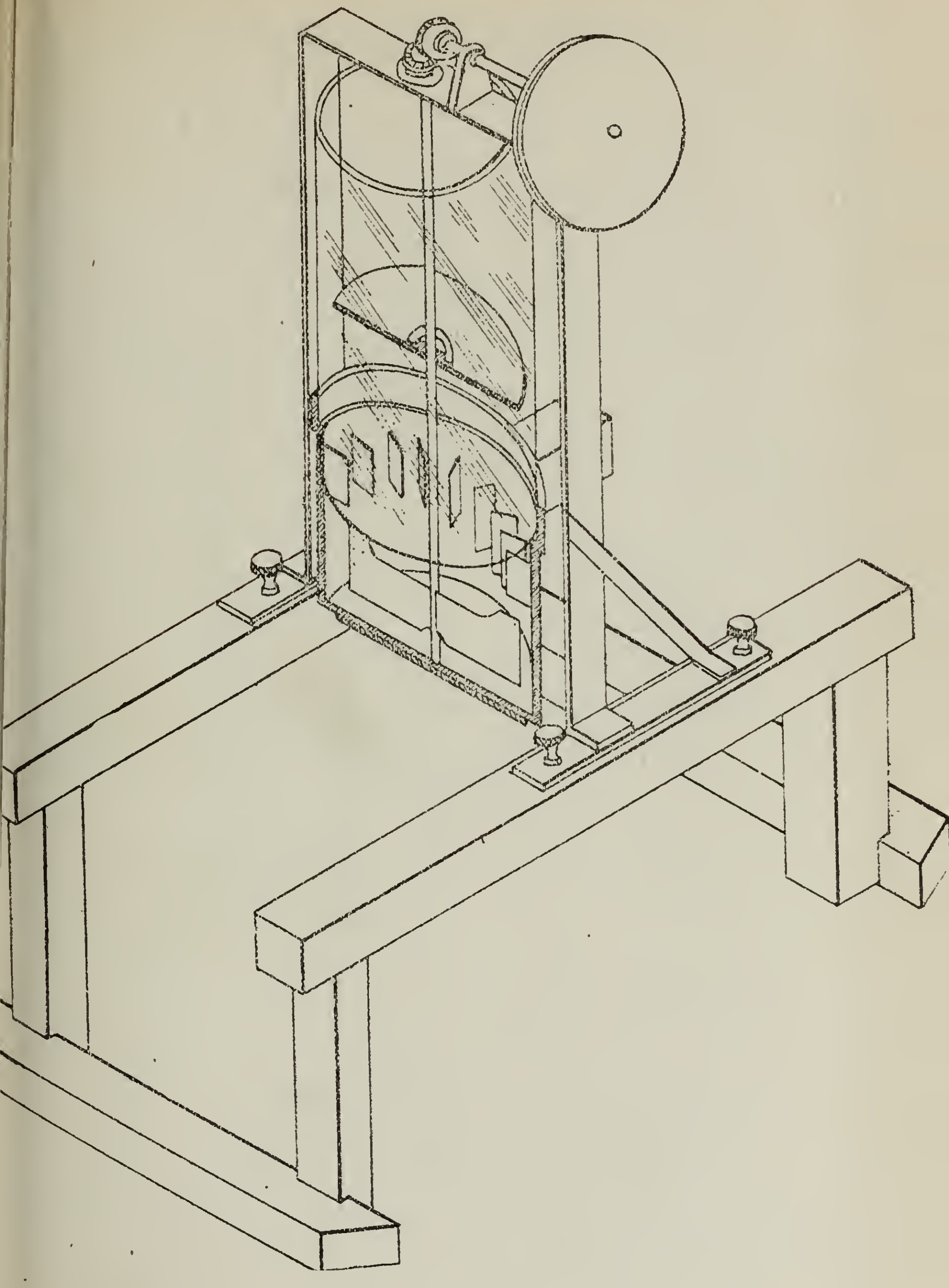
Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Defendant's Exhibit No. 181.

Lantern Slides—Physical Exhibit.

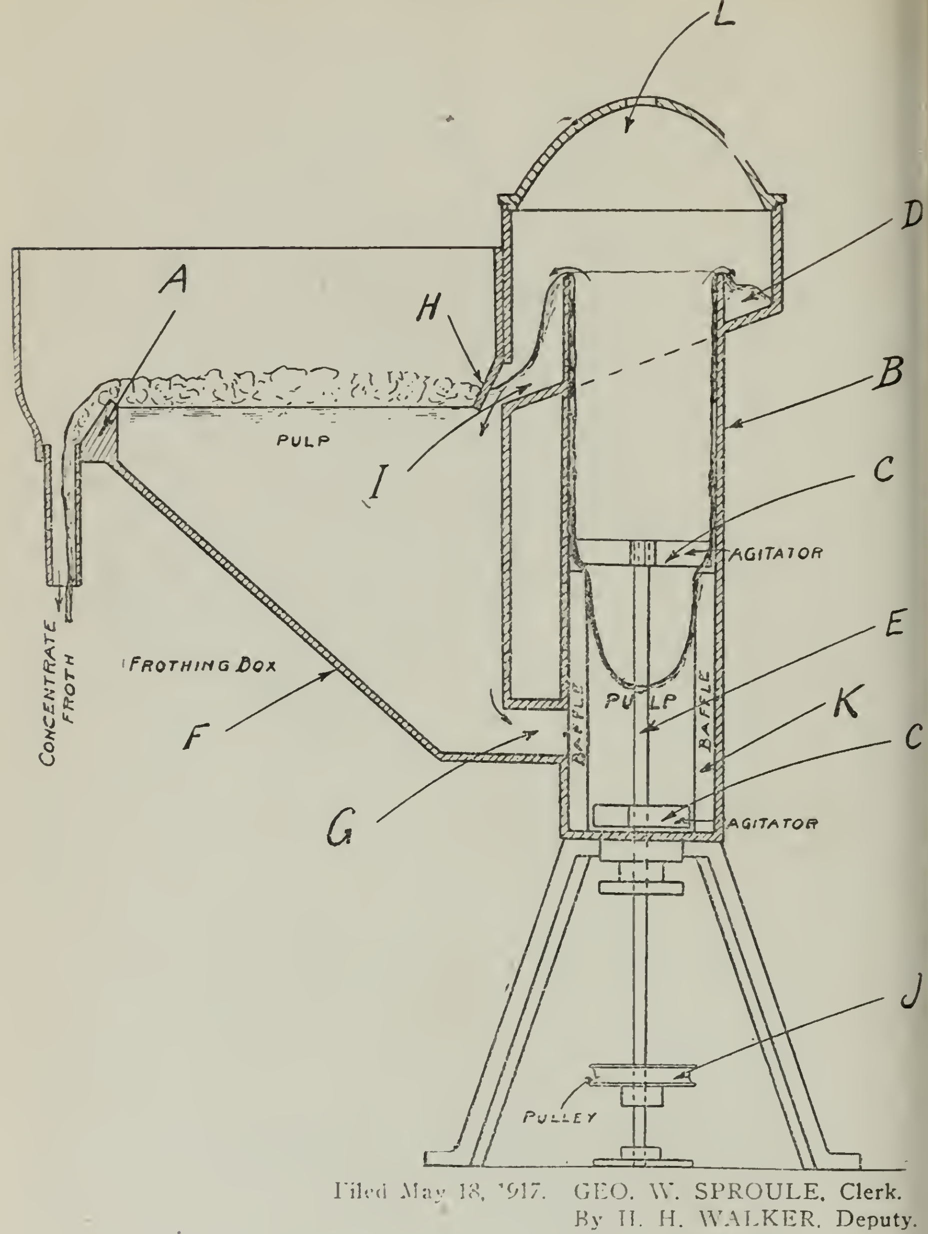
Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Defendant's Exhibit No. 182.



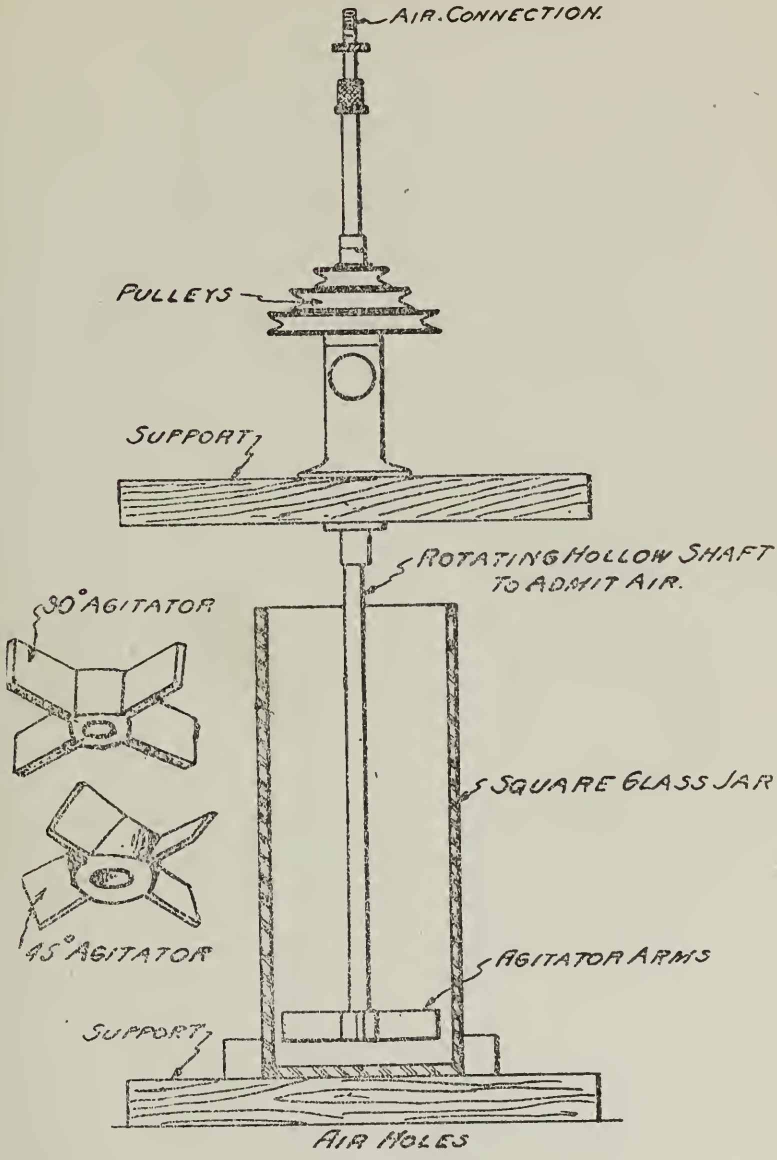
Filed May 18, 1917. GEO. W. SPROULE, Clerk
By H. H. WALKER, Deputy

Defendant's Exhibit No. 183.



Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Defendant's Exhibit No. 184.



Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Defendant's Exhibit No. 185.

Janney machine—Physical Exhibit.

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Defendant's Exhibit No. 186.

Cataract machine—Physical Exhibit.

Filed August 9, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Defendant's Exhibit No. 187.

Fryer Hill machine—Physical Exhibit.

Filed August 9, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Defendant's Exhibit No. 188.

Square Glass Jar machine—Physical Exhibit.

Filed August 9, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Defendant's Exhibit No. 189.

Cone Gabbett including upcast—Physical Exhibit.

Filed August 9, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Ore Flotation*

BY WILDER D. BANCROFT

en discussing the theory of ore flotation, people t to lay great stress upon surface tension in gennd upon contact angles in particular. While this irely legitimate, it seems undesirable, because we t measure a contact angle with any accuracy and se the actual existence of a contact angle is a r of doubt.[1] The problem of ore flotation is a imple one or a very complex one, depending on our of view. It has been customary to consider it as y difficult problem, but the other attitude rather ls to me. There is nothing strange to us in the that water wets glass and that mercury does not. lso know that water does not wet greasy glass ly. If one wishes to say that these facts are mysus, I concede it willingly, because everything bes mysterious if one follows it back far enough. All m is that this is no more mysterious than anything and that if we start with these bits of every-day ledge as given, there are no other serious difficulin connection with ore flotation. Ore flotation is a unique phenomenon, it is merely a special case r the broad heading of emulsions.

a liquid wets a solid, it is adsorbed by the solid, ing a liquid film on the surface of the latter and acing the air film that was there. If a liquid is adsorbed by the solid, it does not wet the solid. formation of a liquid film over the surface of a ed solid accounts for the experimental fact that rise of a liquid in a capillary tube is independent he nature of the walls of the tube. This has always ed a very improbable state of things, and one that d be justified only by the fact that it was so. It mes quite simple, however, the moment we consider the rising liquid does not come in contact with the s of the capillary tube at all. We are really dealing the rise of liquid in a liquid tube, and it makes no erence what material is used to support the walls of liquid tube. That this is the real explanation may seen from the fact that concordant results are not ained when a liquid is allowed to rise in a dry tube. get good results it is important to immerse the tube the liquid and then to raise the tube.

ince the wetting of a solid is a case of selective adption, we should expect that one liquid would wet iven solid more readily than another liquid does, and sequently that the first liquid would displace the ond from contact with the solid. No systematic study this phenomenon seems to have been made, but we ow that alcohol will displace oil in contact with metal[2] d that water will displace kerosene in contact with artz.[3] If we shake a finely divided solid with water d a liquid which is not completely miscible with water, oil for instance, we can distinguish three cases. The id is wetted entirely by water, in which case it stays the water phase and settles to the bottom of it. e solid is wetted entirely by the oil, in which case it ays in the oil phase and sinks to the bottom of it. e solid is wetted simultaneously by oil and water, which case it passes into the interface separating the o liquids. If the oil is less dense than the water, as usually the case, it is a little difficult to distinguish tween the last two cases. If the non-aqueous liquid denser than water, chloroform or carbon tetrachloride r instance, it is difficult to distinguish between the first and third cases. The particles will float if the mean density of solid plus adherent oil film is less than that of the water. They may also float if the action of gravity is not sufficient to overcome the surface tension of the water and thus to pull them through the surface. The maximum weight of substances which can be floated can be calculated from the surface tension under ideal conditions. This calculation applies only when the solid passes into the upper liquid, and does not hold for the case where the solid passes into the interface.

Since we are dealing with selective adsorption, we should expect to find that certain substances would float readily, some others less well, and still others not at all, both the nature of the solid and of the liquid having an effect. This is the case experimentally. Hofmann found that lead iodide, silver iodide, mercuric iodide, mercuric sulphide, and mercuric oxide were floated by ether, butyl alcohol, benzene, kerosene, and amyl alcohol. Copper sulphide, lead sulphide and calcium carbonate were floated only partially by ether, but completely by the other liquids; while zinc sulphide and tin sulphide did not float readily in ether or butyl alcohol, and calcium sulphate was not floated by any of the liquids.

An interesting experiment, which has been done in my laboratory,[4] is to shake copper powder or aluminium powder with kerosene and water. The metallic powder goes into the kerosene and into the interface, producing an effect of molten copper or molten aluminium, as the case may be. When the bottle is allowed to stand after having been shaken, the metallic powder in the interface creeps up the side of the bottle above the surface of the liquid, rising higher if a little alcohol has been added. I have seen an apparently coherent metallic film rise 2 or 3 in. above the surface of the upper liquid phase. If too much copper or aluminium be added, the kerosene cannot hold all of it up and a portion falls to the bottom of the flask, carrying drops of kerosene with it. If the mixture be poured out on a piece of wood, the copper spreads over the surface of the wood just as it did over the surface of the glass. This experiment illustrates the principle involved in all bronzing liquids. A bronzing liquid consists of a volatile liquid which will hold up the metal, and some substance which will keep the metallic powder from rubbing off too readily after it has been applied. The aluminium and copper powders on the market are coated with stearin. This makes them difficult to wet with water, but special experiments have shown that the behavior of copper or aluminium with kerosene is qualitatively the same whether the stearin coating is removed with ether or not.

Similar results can be obtained with colloidal solutions. Isobutyl alcohol[5] was added to a colloidal gold solution obtained by reducing gold chloride with carbon monoxide. When the two liquids are shaken, the gold forms a thin film at the interface. This film is violet blue to blue green by transmitted light and golden by reflected light. A thin water film forms between the isobutyl alcohol and the glass, and the gold concentrates in the dineric interface thus formed, making the alcohol appear uniformly gold-plated. With ether the gold film rises high above the level of the two liquids. With carbon bisulphide the adherent film of gold appears blue. When the carbon bisulphide is broken into drops by shaking, each drop appears blue. When a blue gold was obtained by reducing gold chloride with phosphorus dissolved in ether, the gold went into the dineric interface. When a brownish-red gold was obtained in this way, it remained in the water phase and showed no tendency to pass into the interface. This difference is undoubtedly due to an adsorption of some-

*A paper read at the joint meeting of the New York sections of American Institute of Mining Engineers and the American lectrochemical Society on May 12, 1916.

[1] Rayleigh, Scientific Papers, 3, 354 (1902).

[2] Pockels, Wied. Ann. 67, 669 (1899).

[3] Hofmann, Zeit. Phys. Chem. 83, 385 (1913).

[4] Bancroft, Trans. Am. Electrochem. Soc. 23, 294 (1913).

thing at the surface of the gold, because Reinders found that 0.005 per cent gum arabic prevents colloidal gold from passing into the ether water interface. With carbon tetrachloride, carbon bisulphide, or benzene, the gold goes into the interface as before, but the gum arabic prevents its changing from red to blue.

Colloidal arsenic sulphide goes into the dineric interface with amyl alcohol or isobutyl alcohol, but stays in the water phase when carbon tetrachloride, benzene or ether is the second liquid. India ink goes completely into the interface with amyl alcohol, carbon tetrachloride, or benzene; it goes partly into the interface with isobutyl alcohol, and stays entirely in the water phase when ether is the second liquid.

Winkelblech[6] has shown that mere traces of gelatine in water can be detected by shaking with organic liquids, the gelatine concentrating at the interface to form a film. "A heavy precipitate was obtained when 10 c.c. of a solution containing 0.234 g. gelatine per liter was shaken with benzene. Precipitates were also obtained when the gelatine solution was diluted tenfold, twentyfold and even forty-fold, provided 10 c.c. solution were taken for the test. At the highest dilution the concentration of the gelatine was 0.06 g. per liter, and there were consequently 0.06 mg. in the 10 c.c. taken for the test. This seemed to be about the limit at which a precipitation could be detected definitely. . . . Some other colloids behave like the glue colloid (glutin), and can be shaken out of their solutions. Other hydrocarbons are also effective, so that the phenomenon seems to be a general one. Precipitation was obtained with albumin, water-soluble starch and soap, as well as with resin dissolved in very dilute caustic soda. The colloids grouped as mucin can be precipitated from urine and the proteins from beer. It is worth noting that tannin can be precipitated but not gallic acid.

"The hydrocarbons which can be used are: kerosene, liquid paraffin, benzene, chloroform, and carbon bisulphide [in addition to benzene]. The result varies from case to case. With the hydrocarbons which are lighter than water, the precipitate floats on the water; with the denser hydrocarbon the precipitate is below the water layer The emulsions which form seem to have very nearly the same density as the organic liquid used. It is not possible to get the precipitation with all liquids which are non-miscible or slightly miscible with water. Experiments with ether were entirely unsuccessful.

"As a complement to the action of hydrocarbons on aqueous colloidal solutions it was found that fats dissolved in hydrocarbons or similar liquids can be precipitated in the surface film by shaking with water. Precipitations were obtained with butter, olive oil, lanolin, and vaseline. It was also found that the emulsions of heavy hydrocarbons or carbon bisulphide with the fats of low specific gravity also accumulate below the water layer, only a small portion being carried to the surface by adhering air bubbles. When water is used for shaking out, the precipitation is very slight. With a slightly alkaline solution such as dilute lime water, heavy voluminous precipitates were obtained while a transparent layer of fat is obtained when a slightly acid solution is used. With concentrated alkali or acid solutions, viscous emulsions are obtained which hold fast considerable amounts of solution."

Winkelblech patented the use of such organic liquids as kerosene for clearing sewage by shaking out the colloidal oxidizable matter. The method was not a success commercially, because less than 40 per cent of the oxidizable matter was removed.[7]

Briggs[8] has shown that sodium oleate is removed from solutions of different strengths during the proce emulsifying benzene, and that the amount of thi moval depends upon the strength of the soap sol and the specific surface of the benzene phase. Rayl has observed an interesting case in which dust goes the water layer. "In the course of some experin last year, in illustration of Sir George Stokes' th of ternary mixtures, I had prepared an associatio water, alcohol, and ether, in which the quantity of hol was so adjusted that the tendency to divide int parts was almost lost. As it was, division took after shaking into two nearly equal parts, and parts were of almost identical composition. On p the bottle containing the liquids in the concent light from an arc lamp, I was struck with the co between the appearance of the two parts. The l more aqueous, layer was charged with motes, whil upper, more ethereal, layer was almost perfectly from them. Some years ago I had attempted the e nation of motes by repeated distillation of liqui vacuum, conducted without actual ebullition, but I never witnessed as the result of this process anyt so clear as the ethereal mixture above described.

"The observation with the ternary association, w happened to be the first examined, is interesting, cause the approximate equality of the liquids sug that the explanation has nothing directly to do gravitation. But the presence of the alcohol is necessary. Ether and water alone shaken together hibit the same phenomenon. It would appear that the two liquids are mixed together in a finely div condition, the motes attach themselves by prefer to the more aqueous one and thus when separation two distinct layers follows, the motes are all to be fo below.[11] . . .

"I have lately endeavored to obtain some confirma of the views above expressed by the use of other liq It would evidently be satisfactory to exhibit the a tion of motes by the upper, instead of by the lower, la Experiments with bisulphide of carbon and water, also associations of these two bodies with alcohol, w acts as a solvent to both, gave no definite result, haps in consequence of a tendency to the formation solid pellicle at the common surfaces. But with chl form and water, and with associations of chlorofo water and acetic acid (acting as a common solvent) experiment succeeded. The motes were always colle in the *upper*, more aqueous, layer, even when the c position of the two layers into which the liquid se rated was so nearly the same that a few additional dr of acetic acid sufficed to prevent separation altogeth

The reverse case appears to occur with white lead. Cruickshank Smith[12] says: "During recent years practice has been adopted, largely among white-lead c roders who grind their own white lead in oil, of do away with the final drying of the white lead pulp a comes from the washing process, and grinding or b ing up the pulp (exhausted of water until the proport of the latter does not exceed about 20 per cent) wit suitable quantity of refined linseed oil. This proc depends on the greater surface attraction which wh lead particles offer to linseed oil than to water. enables considerable economies to be effected in manufacture of ground white lead, and it elimina risk of lead poisoning during one of the most danger parts of the white lead manufacturing process."

[6]Zeit. angew. Chem. 19, 1953 (1906).
[7]Biltz and Kröhnke, Zeit. angew. Chem. 20, 883 (1907).
[8]Jour. Phys. Chem. 19, 210 (1915).

[9]Scientific Papers, 3, 569 (1902).
[10]*Association* is here employed as a general term denoting juxtaposition of two or more fluids. Whether the result *mixture* depends upon circumstances.
[11]The clearness of the upper layer, after a mixture of ether alcohol has been shaken up with dust, had already been obser and explained, much as above, by Barus, Amer. Jour. Sci. (3) 122 (1889).
[12]The Manufacture of Paint, 92 (1915).

gh oil is added to float the white lead and consetly the white lead carries the oil down with it," ng the water as upper phase.

hat the adhesion between the solid and the liquid be very marked is shown by the behavior of the alled water wings. These consist of a closely woven readily permeable to air when dry. When thorly wetted, the film of water is strong enough to it of the wings being blown up enough to float a on with ease. Though I know of no direct experis on the subject, it seems probable that the gas sure in some sandstone anticlines may result from oil being displaced by water, which would wet the rock more readily than does the oil.

many of the cases where oil flotation has been oyed we have a sulphide ore, which is much more ily wetted by oil than by water, in presence of a ous gangue, which is much more readily wetted by r than by oil. Consequently the gangue tends to in the water phase while the ore is carried up by il. The use of an acid solution is natural, because dsorbs hydroxyl ions,[11] and these latter cut down adsorption of the solid. Nagel[12] found that when pitated chromic oxide is shaken with water and ene it goes into the dineric interface, but is preated from it by addition of caustic alkali. Zinc ide is also precipitated from the dineric interface rosene and water by addition of alkali. I am aware modern flotation practice is tending to the use of ral slightly alkaline solutions, but in such cases play an important part, and the use of mixed oils introduce a new set of factors. It must also be mbered that acid in ore flotation does not act be of a replaceable hydrogen atom, but by cutting the concentration and consequently the adsorption ydroxyl ions. If calcium ions, for instance, cut the adsorption of hydroxyl ions sufficiently, calhydroxide would behave like an acid, so far as ore tion is concerned, though it would be alkaline to is paper. Somewhat similar cases are known. r electrical stress albumin moves to the cathode in solutions, and also in calcium chloride solutions. ef it is not a question of acidity. The direction in h the albumin moves depends upon the charge of o adsorbed in excess. The hydrogen cation and calcium cation are each adsorbed more than the anion, and consequently the albumin moves to anode in these two solutions. I do not know h anything of this sort is a factor in modern practice.

no systematic experiments have been made to ine the exact effect of temperature, we do not what extent the apparent advantages of a heated are due to a relative change in the selective on, to a change in the relative densities of the ids, or to a change in the viscosities It seems that all three changes are factors, but that the in the selective adsorption is the important one se the absolute adsorption must decrease with emperature, but the selective adsorption may bably does, increase with rising temperature higher temperatures the decrease in absolute ion becomes too serious and there is therefore a im temperature which is not necessarily the nder varying conditions.

now have to consider the part played by air in . Since the density of air is low, it is clear that f adsorbed air or an attached bubble of air will effective in floating a solid particle If we like, we may consider air as an extreme case of a second liquid phase, in which case we may have the solid remaining in the air phase under suitable conditions, concentrating in the interface, or remaining in the water phase. If a piece of metal covered with an air film be laid very carefully on the surface of water, the water may wet it so slowly that the metal will float if it is not too heavy. If the surface of a copper wire be converted to sulphide, it will float more readily because the adsorption of air is more marked. If we have a stearin surface, as in the case of copper powder or aluminium powder, the water has still less tendency to wet the solid, and it becomes quite difficult to cause the commercial copper powder or aluminium powder to sink in water. This difference in readiness to wet is made use of in the film flotation processes of Wood and McQuisten.

The concentration of the solid at the interface occurs when a skin forms over the surface of boiled milk or of cocoa or of a peptone solution. I do not know of any case of ore flotation analogous to this, but doubtless one could be devised if anybody was interested in it. In the case of soap solutions we have a partial concentration in the surface, but the bulk of the soap remains distributed through the water phase. The soap, however, adsorbs so much air that boiling-point determinations on concentrated solutions are worthless.[13]

The selective adsorption of gases and vapors by solids is a matter of common knowledge." The film of condensed gas shows itself in the abnormal mobility of very fine powders, in the fact that two pieces of a broken object will not reunite when pressed together, in a resistance to the passage of an electric spark between solid terminals, and in the behavior of the crystal detector and the coherer as used in wireless telegraphy. All liquids show selective adsorption of gases and vapors. The most striking way in which this shows itself is in the form of the splashes when a drop of water, 5 mm. in diameter, falls on a sheet of water from a height of less than 1 meter. It is this film of adsorbed gas which tends to prevent the coalescence of two soap-bubbles or two impinging jets of water when there is no electrical stress.

Since water removes air more or less quickly from practically all minerals, selective flotation from already wetted ore is practically impossible, and one must have recourse to the combined effect of oil and air. It so happens that in acid or neutral solutions air seems to be adsorbed by organic liquids much more readily than by water[14] Into 100 c.c. approximately normal caustic potash solution 0.5 c.c. chloroform was dropped from a 5 c.c. pipette. The chloroform did not seem to spread out on the surface before sinking so much as it did with water The globules sank to the bottom and flattened out; they were distinctly not very mobile, and seemed to sink to the bottom of the vessel. When the chloroform was dropped into the water it broke up into a number of drops which did not agglomerate so easily as in the water solution. In fact, quite a little shaking was necessary in order to make them coalesce. At first no air bubbles could be detected, but after standing for five minutes a very small bubble appeared on the chloroform Sulphuric acid was then added until the solution became acid. The flattened drop of chloroform at once assumed the shape of a round ball and became mobile An air bubble also appeared in the center of the drop

"Into 100 c.c. approximately normal sulphuric acid solution 0.5 c.c. chloroform was dropped as before The chloroform spread all over the surface and then sank

ttention was first called to this by Mr T R. Briggs
ney, Jour Phys. Chem. 19, 360 (1915)
Phys Chem 19, 570 (1915)

[12]McBain and Taylor, Zeit. phys. Chem. 76, 183 (1911)
[13]Bancroft, Jour Phys. Chem 20, 1 (1916).
[14]Twomey Jour Phys Chem 19, 360 (1915)

through the solution in small drops, forming round globules with air bubbles clinging to each. It was hard to get rid of the bubbles on the chloroform drops by shaking; as soon as one was driven off another bubble appeared exactly in the center of the drop. When the bubbles were dislodged from the drops, they rose to the surface carrying with them some chloroform, a part of which remained on the surface until it evaporated, while the rest sank back to the bottom of the solution. The globules were very mobile and coalesced readily. Caustic potash was added to the solution, making it alkaline. The chloroform globule flattened immediately and the air bubble in the center disappeared. In still another experiment an acid solution was made alkaline, then acid, and then alkaline again. The result confirmed Wilson's experiments,[a] for the drop of chloroform was always flat in the alkaline solution and always round in the acid solution. There is scarcely any difference to be noted between the shape of the drop in acid solution and in pure water. The same results were obtained when NaOH and HCl were substituted for KOH and H_2SO_4.

"In one experiment in a nitric acid solution the temperature was raised to about 40 deg. C. Bubbles seemed to shoot from all parts of the solution to the chloroform drop. When they had formed a large bubble in the center of the chloroform, the air bubble rose to the surface of the solution as in the other cases."

Of course, it does not follow that the relative adsorption of gas is always greater for oil in acid solution, but merely that this seems to be true in the cases hitherto studied. It is purely an empirical observation. Another interesting fact is the difficulty that is experienced in getting air bubbles to attach themselves in some cases to the oil films surrounding the solid particles. Some people have even claimed that nascent gas is essential, but this is absurd. If the air bubble comes in contact with the oil it will adhere; but it is not easy to bring about this contact. It can be done by vigorous agitation or by causing dissolved gas to come out of solution, but the essential thing is merely to bring the gas in actual contact with the oil.

A large air bubble will have a relatively great lifting power, but it will also tear loose very readily from an oiled particle. We shall get better results if we produce a froth consisting of bubbles of air in oil. Under ideal conditions the film around the bubbles will consist of particles coated with oil. We cannot get a froth with a pure liquid and air. There must be present a third substance in colloidal solution which will tend to form an emulsion of air in the liquid in question, for a froth is essentially a very concentrated emulsion of air in liquid. If the colloidal material is not present in the liquid it must be added. It has often been overlooked that what is needed for ore flotation is a froth of air in oil. People have said to themselves that froth is what is needed and have added saponine and other things with disastrous results. Saponine produces a froth, but it is a froth of air in water and therefore plays havoc with flotation. The things which have proved successful are substances like sodium resinate so called, which produces a froth of air in water in an alkaline solution but one of air in oil in an acid solution, because free rosin forms a colloidal solution in oil but not in water. Mr. Van Arsdale has worded the matter in what seems a different way by saying that the substance added must tend to emulsify water in oil and not oil in water. This is very nearly the same thing, because substances which form colloidal solutions in oil and not in water tend to emulsify water in oil.[b] I have preferred to consider the oil-air interface a... Van Arsdale the oil-water interface, but the two ... of view lead to the same conclusions in almost al...

So far, we have been considering the case wh... have a fair amount of oil. If we cut the amo... oil down almost to a vanishing quantity another ... comes in, namely, air flotation. When sufficient ... ties of oil are used, the air floats the oil and ... floats the ore. The ore is inclosed in a drop of ... ing the properties of matter in mass and sinks ... bottom of the drop of oil, distorting it to a gr... lesser extent. If the amount of oil is decreas... ciently, we no longer have an oil drop surroun... particle of ore, but an oiled particle, the lower ... which is, or may be, in contact with water, w... upper part is in contact with air. We are th... getting air effect in addition to the oil effect. I ... know the relative importance of these two effects ... has been claimed—and disputed—that the modi... flotation is of much greater value than the oth... the Wood and the McQuisten processes there is n... but that the separation would be more effecti... were possible to cover the ore particles with a t... of stearin, leaving the gangue particles uncoat... is very difficult to wet the stearin-coated com... copper and aluminium powders, and it is therefo... difficult to make them sink under water. In the ... processes of ore flotation using very little oil ... we get a thin coating on the ore analogous ... stearin coating on the copper or the aluminium ... It is possible that the air film may surround th... particle completely so that the oil does not c... actual contact with the water. In that case we a... to a straight air flotation of oiled particles. Thi... calls for further study because, if established, it ... have a very important bearing on the future d... ment of the subject.

It is under these circumstances that addition o... oil causes the ore to cement together and sink... reason for this will perhaps be seen more easily ... consider the analogy of sand and water. When ... water is mixed with sand, we get a quicksan... which it is unsafe to walk. With only a little ... we get a plastic mass over which it is a plea... walk and out of which children can make fort... etc. When the sand dries out more, air gets in b... the grains, and the walking becomes hard, thou... sand is by no means dry from a chemical point o... When the amount of oil round the ore particles i... ciently small, the air gets in and makes a froth p... With more oil we get a plastic mass; with sti... we get the bulk oil process.

Anderson[c] classifies flotation oils as "frothin... "collecting" oils.[d] "There is at times some diffic... grasping the distinction between frothers and co... as such, for one oil in itself may, and often do... sess both frothing and collecting properties. The ... of a frothing oil is such as to produce froth in ... or less amount, dependent on the frothing power ... oil. A collecting oil has a collecting power f... phides in preponderance over its frothing action ... therefore, so to speak, a poor frother; a collect... may have simply a collecting action and little ... frothing action. As stated in the foregoing, so... combine both the properties of frothing and col... in variable degrees of each.

"The most successful frothing oils include t... oils, cresylic acid and turpentines and other py... ous products from the distillation of wood— ... methyl alcohol." The coal tar phenols and the ...

[a]Wilson, Jour. Chem. Soc. 1, 174 (1848).
[b]Bancroft, Jour. Phys. Chem. 17, 516 (1913).

[c]Met. & Chem. Eng. 14, 136 (1916).
[d]Van Arsdale calls them "foamers" and "oilers."
[e]This must be an error W. D. B.

tive and almost all of the so-called essential oils od others. The essential oil of eucalyptus finds particularly in Australian practice, on account tive low cost and immediate supply. Castor oil, ch ference has already been made, when mixed ith erosene has found application. The more s products of petroleum, including kerosene and e have been successful frothing oils."

cal mineral oils and tar oils do not generally g flotation froth, but have a marked selective or he sulphide minerals. Among the mineral e cluded the following: asphaltum base, crude un refined oil, gasoline, burning oil, creosol, and r cosotes."

is and that thick oils tend to form viscous, co- flotation concentrates, while thin oils form less at asses. The action of coal tar in stiffening a ep mineral froth is indicative of the former. In l e essential oils give a coherent froth and sat- ry extraction; oils like oleic acid or candle- s d oil, petroleum, and lubricating and engine av a strong tendency to produce heavy, thick es which will not float. Oleic acid has a well- l wer to float silicates."

re liquid does not form a froth with air, it at no oils can be frothing oils except in so ey contain suitable colloidal material sus- them. In some cases this colloidal material n other cases it is for the organic chemist to t what the special substance is. Since the t of the frothing oils is due to the colloidal s, it is a question of cost whether it is more ous to mix a frothing oil with a collecting oil the constituent which makes the former a oil.

we are dealing with selective adsorption, we pect to find that some oils would be better than r certain purposes.

on[2] states that "oils derived from the destruc- llation of wood, such as wood creosotes, pyro- acid, and the like, are found to give the best en galena and zinciferous material; coal-tar are better adapted to the successful flotation -bearing minerals." There are no independent n which this result could have been predicted. flotation is due to selective adsorption, any- ich will change the latter will change the degree ire of flotation as far as the oil-water flotation ned. Adding a third liquid which is miscible other two, will tend to make the oil and water ore nearly alike in composition and therefore rties. This gives us a possibility of varying tive adsorption within certain limits and its ties should be determined, even though there no economic advantages. [Now that we are a re clear as to the cause of frothing, it becomes to study new frothing agents more successfully possible that some of these might have distinct g powers of their own.] In some experiments made at Cornell by Mr. Briggs, it has been at addition of salt made it easier to shake out ferric oxide with benzene. The reason for as to be that the salt makes the colloidal solu- stable. Any substance which prevents peptiza- he water phase or promotes it in the oil phase l to increase the flotation. I do not yet know extent this is applicable to ore flotation; but n[3] reports that experiments performed on a 60- oduct from the Joplin district containing pyrite na in a calcareous gangue showed: that potassium bichromate will deaden galena and permit the flotation of the pyrite; that sodium, potassium, and ferric sulphates promoted the production of clean concentrates; and that ferrous sulphate and cupric sulphate were very harmful to the successful flotation of this particular product, flotation being practically impossible in their presence. Anderson, of course, ventures no opinion as to why these salts act in this way; but it ought not to be difficult to work out a hypothesis if some data were forthcoming. The inadequacy of the present data is made clear by the statement of R. H. Richards that in the case of a certain Tennessee zinc ore the addition of a small amount of copper sulphate was necessary in order to bring about successful flotation. We have not yet made any experiments on the factors affecting the air flotation when the oil is reduced to a minimum, so I will not discuss that point at all.

There seems to be no reason to suppose that ore flotation has yet gone beyond the first stages of its development, and certainly a clear knowledge of the general theory should be a help in promoting the development.

Cornell University.

[2] nd Chem. Eng. 14, 136 (1916).
[3] nd Chem. Eng. 14, 137 (1916).

Newark Industrial Exposition

The Industrial Exposition being held at Newark, May 18 to June 3, in the First Regiment Armory, Jay Street (reached by Central Avenue trolley), is representative of the large manufacturing interests of that city. The exhibits are nicely arranged and include a large variety of industries. Among the industrial concerns having space are the following:

Gamon Water Meter Co., water meters.

Standard Oil Co. of New Jersey, Polarine oils and lubricants.

Newark Wire Cloth Co., wire cloth for industrial purposes and screens up to 300 mesh.

Crocker-Wheeler Co., generators, motors.

Westinghouse Electric Co., generators, motors, meters, Westinghouse Mazda lamps.

Murphy Varnish Co., varnish pigments, oils, small grinding rolls, filter presses, etc.

Celluloid Co., celluloid articles.

Driver-Harris Wire Co., Nichrome heat-resisting metal, Monel metal wire, small-wire drawing machine, demonstrating the drawing of copper wire from 0.016 in. to 0.0063 in.

Newark Leather Machinery Company, and combined exhibits of Newark's leather companies showing different leathers manufactured.

National Oil & Supply Co., Viscos oils and greases.

Combination Rubber Mfg. Co., hose, packing, etc.

Thomas A. Edison, chemicals, phenol, aniline, etc.

Edison Storage Battery Co., Alkaline storage battery.

General Electric Co., Edison Lamp Works, Mazda lamps, historical exhibit showing development of incandescent lamp.

Anti-Hydro Waterproofing Co., waterproof liquid, waterproof paint, for brick, concrete, etc.

F. W. Horstmann Co., McDowell feed-water heater and purifier.

Bureau of Standards Analyzed Samples.—The Bureau of Standards, Washington, D. C., now has ready for distribution a new sample of its iron D, No. 6-b, replacing No. 6-a, which has been long out of stock. The composition of the new sample is: carbon, 2.39; graphite, 1.79; silicon, 2.59; titanium, 0.077; phosphorus, 0.531; sulphur (grav.), 0.046; manganese, 1.54; copper, 0.044; chromium, 0.014; vanadium, 0.025; nickel, 0.026. Until printed certificates can be had a provisional certificate of analysis, without details, will be furnished with each sample issued.

Defendant's Exhibit No. 191.

CHINO COPPER COMPANY

HURLEY PLANT

Data Compiled from Statement (Form 12-C) Showing Results of Operation of Vanner Concentrate Flotation Plant

Month of November, 1916.

FLOTATION PLANT FEED

DATE— Nov. 1916	Lbs. Oil Per Ton	% Solids	Dry Tons Per 24 Hrs.	Assay % Copper	Computed % Cu^2S	Assay % Iron	% Iron as FeS_2	Assumed FeS_2 in Conc. and Fe Oxide in Tails — Computed % FeS_2	Comp % Tot Sulph
1	8.06	46.43	420	3.60	4.51	17.8	6.7	14.4	18.9
2	7.96	41.58	360	4.03	5.05	13.1	4.7	10.1	15.2
3	12.09	39.31	330	5.87	7.37	13.5	6.3	13.5	20.9
4	10.09	40.46	284	6.83	8.56	11.1	6.7	14.4	23.0
5	6.97	40.42	318	5.00	6.26	11.5	6.1	13.1	19.4
6	9.23	37.40	310	4.60	5.76	15.3	6.7	14.4	20.2
7	10.04	36.71	282	5.43	6.81	12.8	6.9	14.8	21.6
8	11.53	34.58	235	7.53	9.44	9.2	5.9	12.7	22.1
9	10.06	37.31	248	6.03	7.56	12.3	5.2	11.2	18.8
10	8.97	36.12	291	7 40	9.27	12.1	5.8	12.5	21.8
11	6.15	37.86	334	8.30	10.40	12.0	5.4	11.6	22.0
12	10.67	39.41	312	8.77	11.00	9.1	4.8	10.3	21.3
13	9.05	40.23	375	8.37	10.45	7.1	3.3	7.1	17.6
14	10.80	41.36	345	8.40	10.55	10.2	4.3	9.2	19.8
15	12.22	38.25	270	8.23	10.35	10.0	6.4	13.8	24.1
16	14.23	41.56	292	9.93	12.45	16.0	6.9	14.8	27.2
17	15.46	41.83	280	10.23	12.85	12.7	5.5	11.8	24.6
18	23.98	30.53	176	9.20	11.40	10.7	4.8	10.3	21.7
19	20.61	32.10	206	12.03	15.10	10.5	5.1	11.0	26.1
20	26.98	26.92	179	9.20	11.40	9.6	6.6	14.2	25.6
21	17.68	36.64	244	9.63	12.05	10.8	7.0	15.0	27.0
22	11.31	43.81	358	8.13	10.20	20.0	7.8	16.8	27.0
23	11.81	40.64	326	5.50	6.91	19.2	8.2	17.6	24.2
24	15.09	34.40	285	6.67	8.38	15.1	9.1	19.5	27.9
25	26.14	28.32	184	7.83	9.85	9.2	8.0	18.2	28.0
26	17.37	32.07	247	7.43	9.32	14.1	9.2	19.5	28.8
27	17.85	33.59	221	8.40	10.55	19.5	16.0	34.3	44.9
28	18.41	29.48	208	10.23	12.85	11.4	10.2	21.8	34.6
29	15.51	36.52	254	10.30	12.90	9.8	6.8	14.6	27.5
30	15.04	35.25	270	10.23	12.85	11.1	7.4	15.9	28.7

Compiled from
Original Record
April 26, 1917.

(Signed) F. R. WICKS,
Asst. Supt. of Mills.

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Defendant's Exhibit No. 192.

RAY CONSOLIDATED COPPER COMPANY

HAYDEN PLANT

Data Compiled from Monthly Statements (Form No. 62-R) Showing Results of Operation of Vanner Concentrate Retreatment Plant During Year 1916—Divided Into 10-Day Periods.

Period	Lbs. Oil Per Ton	% Water In Feed	ASSAY PLANT FEED % Copper	% Iron	% Total Cu. & Fe.
1	4.21	79.00	5.97	7.04	13.01
2	3.22	77.00	5.64	7.14	12.78
3	2.93	78.00	6.39	7.15	13.54
4	......	....	......	......	....
5	3.20	74.00	5.01	6.70	11.71
6	......	....	......	......	....
7	2.96	73.00	4.54	6.18	10.72
8	3.28	73.00	4.57 6	6.40	10.97
9	3.53	76.00	4.88	6.32	11.20
10	3.26	77.00	5.20	6.78	11.98
11	3.41	76.00	5.40	6.86	12.26
12	3.36	75.00	5.12	7.16	12.28
13	3.41	79.00	6.06	7.68	13.74
14	3.01	73.00	5.42	6.77	12.19
15	3.16	75.00	5.26	6.71	11.97
16	3.21	76.00	5.15	6.70	11.85
17	3.13	75.00	5.60	7.19	12.79
18	3.16	78.00	5.96	6.95	12.91
19	3.13	77.00	5.37	6.39	11.76
20	......	....	......	......	....
21	3.43	77.00	5.55	6.86	12.41
22	2.72	79.00	6.52	8.22	14.74
23	3.18	80.00	5.76	6.92	12.68
24	3.45	79.00	5.98	7.34	13.32
25	2.83	81.00	5.88	6.84	12.72
26	3.02	79.00	5.73	6.29	12.02
27	3.89	79.00	6.35	6.75	13.10
28	4.24	78.00	6.02	6.56	12.58
29	3.85	79.00	5.97	6.47	12.44
30	4.00	80.00	6.31	7.05	13.36
31	2.81	79.00	5.89	6.74	12.63
32	2.32	78.00	6.05	6.10	12.15
33	2.66	79.00	6.70	6.55	13.25
34	3.65	78.00	6.05	6.36	12.41
35	3.63	79.00	6.24	6.27	12.51
36	......	....	......	......	....

Compiled From
Original Periodical
Record

E. W. ENGELMAN,
Flotation Engineer.

April 30, 1917.

Filed May 18, 1917. GEO. W. SPROULE, Clerk.

By H. H. WALKER, Deputy.

Defendant's Exhibit No. 193.

RAY CONSOLIDATED COPPER CO.

HAYDEN PLANT

Data compiled from monthly statements—(Form No. 62-R)—showing results of flotation operations for 10-day periods during year 1916. Slime vanner tailing plant.

Periods	Pounds of Oil Per Ton	% of Water in Feed	ASSAY PLANT FEED % Copper	% Iron	% Total Cu & Fe.
1	1.53	81.0	.867	1.62	2.49
2	1.53	81.0	.812	1.63	2.44
3	1.82	83.0	.903	1.76	2.66
4	......	......	......	......	......
5	1.25	80.0	.814	1.64	2.45
6	1.26	80.0	.818	1.60	2.42
7	1.28	80.0	.785	1.54	2.33
8	1.48	78.0	.810	1.67	2.48
9	1.25	79.0	.896	1.61	2.51
10	.73	78.0	.840	1.59	2.43
11	.77	75.0	.816	1.73	2.55
12	.79	78.0	.726	1.70	2.43
13	.79	77.0	.710	1.67	2.38
14	.99	76.0	.708	1.61	2.32
15	.77	76.0	.680	1.65	2.33
16	.96	77.0	.700	1.72	2.42
17	.95	76.0	.784	1.60	2.38
18	.88	76.0	.770	1.62	2.39
19	.77	75.0	.754	1.68	2.43
20	......	......	......	......	......
21	.69	73.0	.719	1.55	2.27
22	.69	79.0	.780	1.72	2.50
23	.74	78.0	.738	1.52	2.26
24	.79	77.0	.713	1.67	2.38
25	.84	78.0	.749	1.73	2.48
26	.88	79.0	.782	1.71	2.49
27	.80	79.0	.805	1.64	2.45
28	.85	77.0	.839	1.67	2.51
29	.82	78.0	.812	1.71	2.52
30	.76	78.0	.700	1.63	2.33
31	.66	77.0	.665	1.64	2.31
32	.73	77.0	.762	1.57	2.43
33	.72	77.0	.753	1.55	2.30
34	.66	78.0	.756	1.58	2.37
35	.63	78.0	.745	1.62	2.36
36	.71	80.0	.783	1.57	2.35

Compiled From Original
Periodical Record.
April 30, 1917.

E. W. ENGELMANN,
Flotation Engineer.

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Defendant's Exhibit No. 194.

BUTTE & SUPERIOR MINING COMPANY

Data Compiled From Original Records of Flotation Plant Operations, Month of November, 1916. Flotation Plant Feed.

Date Nov. 1916	Lbs. Oil Per Ton	% Solids	Assay % Zinc	Computed % ZnS
1	1.67	22.2	15.0	22.4
2	1.50	20.5	13.9	20.7
3	1.48	21.7	13.3	19.8
4	1.50	21.2	14.6	21.8
5	1.55	20.0	13.6	20.3
6	1.53	21.7	15.3	22.8
7	1.74	17.7	13.8	20.5
8	1.75	18.5	14.2	21.1
9	1.58	21.7	15.2	22.6
10	1.52	21.0	15.1	22.5
11	1.50	22.7	12.7	19.0
12	1.91	17.7	13.0	19.4
13	1.68	19.5	12.4	18.5
14	1.28	21.5	12.8	19.1
15	1.56	19.5	11.7	17.5
16	1.44	21.7	15.4	22.9
17	1.16	25.0	13.9	20.7
18	1.28	24.5	12.3	18.4
19	2.37	16.7	12.0	18.0
20	1.23	22.5	12.1	18.0
21	1.40	21.7	11.6	17.3
22	1.58	22.2	11.2	16.7
23	1.44	22.2	11.2	16.7
24	1.43	23.2	12.4	18.5
25	1.40	22.7	12.5	18.7
26	1.69	18.5	11.5	17.2
27	1.31	25.0	11.1	16.5
28	1.36	22.2	12.0	17.9
29	1.54	21.5	12.5	18.6
30	1.36	22.7	12.9	19.2

Compiled From Original Record
April 28th, 1917.

J. T. SHIMMIN,
Mill Superintendent.

Filed May 18, 1917. GEO. W. SPROULE. Clerk.
By H. H. WALKER, Deputy.

Defendant's Exhibit No. 195.

UTAH COPPER COMPANY

MAGNA PLANT

METALLURGICAL DEPARTMENT

Data Compiled From Statement Giving Average Results by Months of Operation of Vanner Concentrate Flotation Plant.

September, 1914, to December 1st to 24th, Incl., 1916.

DATA PLATTED ON CHART NO. 1.

	Dry Tons Treated	% Solids in Feed	Lbs. New Oil Per Ton of Original Feed
1914			
Sept.	9,258	41.67	3.05
Oct.	10,085	45.46	2.62
Nov.	13,104	50.00	2.11
Dec.	11,776	40.76	2.23
1915			
Jan.	10,171	42.78	3.97
Feb.	12,686	44.20	1.83
March	16,430	42.89	1.23
April	18.350	42.13	1.85
May	20,229	40.42	2.20
June	19,036	32.10	3.84
July	17,613	36.58	4.63
Aug.	17,778	34.72	3.81
Sept.	19,014	39.40	3.85
Oct.	20,792	40.86	3.77
Nov.	21,211	42.08	4.32
Dec.	21,216	40.56	4.71
1916			
Jan.	18,527	37.18	5.11
Feb.	19,000	34.96	4.97
March	20,003	29.20	5.20
April	21,425	28.82	5.37
May	24,142	31.12	4.69
June	28,510	30.66	3.93
July	29,910	29.20	3.90
Aug.	30,333	32.08	3.87
Sept.	30,266	33.34	3.95
Oct.	32,494	33.20	3.75
Nov.	30,375	33.82	3.76
Dec. (1-24)	24,429	33.45	3.83

Compiled From
Original Record
Apr. 30, 1917.

(Signed) R. A. CONRADS,
Metallurgical Engineer.

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

UTAH COPPER COMPANY

MAGNA PLANT

METALLURGICAL DEPARTMENT

Data Compiled From Original Records of Operation of Vanner Concentrate Flotation Plant, for the Year 1916; This Compilation Embraces the Days of the Year on Which the Percentage of Solids in Flotation Feed Was Not Under 31% Nor Over 33%.

DATA PLATTED ON CHART NO. 2.

Date 1916	Per Cent Insol.	Per Cent Solids	Lbs. Oil Per Ton
Jan. 12	73.74	32.47	6.12
Jan. 13	73.02	32.69	6.06
Jan. 28	77.76	32.57	6.34
Feb. 13	75.87	31.58	5.00
Feb. 14	75.91	31.01	4.57
Feb. 18	73.08	32.83	4.89
Feb. 19	73.95	31.70	5.35
Feb. 20	73.63	32.30	5.34
Feb. 28	74.24	31.52	5.27
Mar. 7	74.47	32.52	5.03
Mar. 9	74.40	31.21	5.39
Mar. 15	71.35	31.57	4.71
Mar. 16	73.70	31.46	5.40
Apr. 19	72.93	31.90	5.68
Apr. 23	73.16	31.76	5.63
Apr. 25	73.26	32.05	5.41
May 7	77.48	32.17	4.66
May 14	73.38	32.46	4.11
May 21	76.71	31.91	4.57
May 22	76.26	32.53	4.45
May 24	77.46	31.38	4.97
May 29	72.92	31.85	4.54
May 31	73.77	32.96	3.79
June 5	75.42	32.29	4.08
June 6	73.60	32.04	3.95
June 7	75.06	31.42	3.57
June 12	75.31	31.73	4.16
June 14	72.60	31.93	3.95
June 20	75.59	31.80	3.83
June 21	76.72	31.68	4.12
June 23	75.89	32.08	3.45
June 29	76.07	31.68	3.82
July 8	74.84	31.42	3.70
July 25	75.57	31.24	4.20
July 31	[illegible]	[illegible]	[illegible]

Aug. 9	75.46	31.61	[illegible]
Aug. 12	75.70	32.49	3.66
Aug. 13	75.44	32.31	3.82
Aug. 14	75.70	31.14	3.67
Aug. 22	74.11	31.53	3.84
Aug. 24	74.53	32.22	3.84
Aug. 25	75.10	31.57	3.88
Aug. 26	74.71	31.99	4.18
Aug. 28	73.81	32.22	4.13
Aug. 31	74.84	32.68	4.05
Sept. 4	72.95	32.28	4.28
Sept. 11	75.86	32.86	3.88
Sept. 12	75.77	31.15	4.23
Sept. 14	75.10	31.95	4.42
Sept. 18	74.80	31.22	4.30
Sept. 20	73.06	32.03	4.03
Sept. 22	74.08	31.96	3.99
Sept. 23	74.60	31.54	4.24
Sept. 24	74.13	31.70	3.99
Sept. 26	75.00	32.30	4.29
Sept. 27	74.40	32.40	3.84
Oct. 7	74.82	31.12	4.14
Oct. 8	74.47	31.36	3.89
Oct. 14	75.10	32.36	3.75
Oct. 16	73.76	32.89	3.67
Oct. 18	72.94	32.41	3.76
Nov. 8	77.51	31.02	4.23
Nov. 11	75.42	32.57	3.67
Nov. 12	75.58	31.99	3.83
Nov. 17	76.25	32.70	3.59
Nov. 18	77.00	32.63	3.64
Nov. 19	75.08	32.83	3.52
Nov. 20	79.08	31.12	5.22
Dec. 7	77.70	32.58	3.58
Dec. 8	77.68	32.35	3.62
Dec. 12	76.36	32.71	4.07
Dec. 15	77.54	31.40	3.74
Dec. 19	75.84	31.96	3.37
Dec. 23	77.76	32.66	3.83

Compiled From
Original Record
Apr. 29, 1917.

(Signed) R. C. CONRADS,
Metallurgical Engineer.

Filed May 18, 1917. GEO. W. SPROULE, Clerk
By H. H. WALKER, Deputy

Defendant's Exhibit No. 197.

UTAH COPPER COMPANY

MAGNA PLANT

METALLURGICAL DEPARTMENT

Data Compiled From Original Records of Operation of Vanner Concentrate Flotation Plant for Year 1916.

This Compilation Embraces the Days of the Year on Which the Percentage mineral (100% - % Insol.) in Feed Was Between 24.5% and 25.5%.

DATA PLATTED ON CHART NO. 3.

1916 Date	% Insol.	% Solids	Lbs. Oil Per Ton
1- 1	75.13	37.07	4.61
1-11	75.23	33.71	5.87
1-16	75.15	34.57	5.00
3- 5	75.33	28.58	5.57
3- 8	74.58	26.44	5.68
3-10	75.46	30.58	5.70
3-17	74.62	26.20	6.65
3-27	74.76	26.94	4.55
3-29	74.83	29.34	4.26
4- 6	74.70	30.49	4.16
4-10	74.66	29.89	5.54
4-14	75.06	30.09	5.74
4-28	75.33	28.76	5.19
4-30	74.96	28.29	5.78
5- 3	74.67	28.70	5.87
5- 4	75.49	30.10	5.51
5- 5	74.77	29.77	5.73
5-12	74.80	30.54	4.45
5-17	75.36	34.03	4.47
5-26	75.31	33.08	5.15
6- 1	74.94	33.98	4.08
6- 3	75.36	33.02	4.36
6- 5	75.42	32.29	4.08
6- 7	75.06	31.42	3.57
6- 8	74.50	29.97	3.64
6-12	75.31	31.73	4.16
6-15	75.47	27.91	4.28
6-24	[illegible]	[illegible]	[illegible]

7-29	75.17	29.23	4.15
8- 1	74.53	31.02	4.17
8- 9	75.46	31.61	3.76
8-10	75.33	29.62	3.94
8-13	75.44	32.31	3.82
8-21	75.47	34.05	3.78
8-23	75.30	35.95	3.90
8-24	74.53	32.22	3.84
8-25	75.10	31.57	3.88
8-26	74.71	31.99	4.18
8-27	74.84	33.27	3.97
8-31	74.84	32.68	4.05
9- 1	74.70	35.88	4.29
9- 7	75.70	33.34	4.20
9- 8	74.65	33.90	3.81
9-14	75.10	31.95	4.42
9-18	74.80	31.22	4.30
9-23	74.60	31.54	4.24
9-25	74.83	30.45	4.57
9-26	75.00	32.30	4.29
9-28	75.20	34.43	3.63
10- 3	75.11	33.34	3.78
10- 7	74.82	31.12	4.14
10-12	74.85	30.60	4.03
10-14	75.10	32.36	3.75
10-23	75.00	34.16	3.63
10-30	75.43	34.29	3.80
11- 6	75.13	35.12	3.81
11- 9	74.50	35.30	3.78
11-10	74.76	34.34	3.70
11-11	75.42	32.57	3.67
11-19	75.08	32.83	3.52
11-26	74.80	36.10	3.42
11-30	74.80	37.74	3.39
12- 2	75.32	34.40	3.56
12- 4	74.89	34.75	3.03
12- 6	75.36	33.45	3.67
12-14	75.11	35.54	3.90
12-17	75.33	34.61	3.73
12-18	74.93	36.37	3.72

Compiled From
Original Record
April 29, 1917.

(Signed) R. A. CONRADS,
Metallurgical Engineer.

Defendant's Exhibit No. 198.

UTAH COPPER COMPANY

ARTHUR PLANT

METALLURGICAL DEPARTMENT

Data Compiled From Original Record of Operation of Flotation Plant Treating Original Slime Feed.

The Dates Embraced in This Compilation Are Sept. 1st to Oct. 31st, 1916, Inclusive, Excepting Oct. 8th to 12th Inclusive, on Which Days a Different Oil Mixture Was Used.

DATA PLATTED ON CHART A NO. 1.

Date	HEADING		Lbs. Oil Per Ton	% Solids
	% Cu.	% Fe.		
Sept.				
1	.939	1.47	1.26	17.37
2	.957	1.35	1.21	18.07
3	1.111	1.12	1.34	17.79
4	1.162	1.20	0.98	20.03
5	1.097	1.80	1.35	17.05
6	1.075	1.50	0.82	19.30
7	1.193	1.30	1.21	19.98
8	1.066	1.35	1.22	16.25
9	1.052	1.33	1.41	16.49
10	1.119	1.35	1.25	17.91
11	1.080	1.73	0.95	18.58
12	1.048	1.65	1.16	17.31
13	1.067	1.05	1.17	21.20
14	1.042	1.47	1.46	17.60
15	1.022	1.60	1.32	16.49
16	1.056	1.33	1.21	17.34
17	.873	1.50	1.41	17.74
18	.874	1.33	1.35	17.75
19	.901	1.60	1.45	17.26
20	1.010	1.57	1.05	18.32
21	1.000	1.85	1.29	17.43
22	[illegible]	[illegible]	[illegible]	[illegible]

30	.950	1.28	[illegible]	[illegible]
Oct.				
1	.997	1.16	1.13	18.39
2	1.087	1.18	1.32	15.53
3	1.066	1.52	1.29	16.74
4	1.092	1.42	1.52	18.94
5	1.148	1.35	1.65	18.20
6	1.035	1.46	1.61	16.56
7	1.125	1.15	1.39	15.90
13	.992	1.16	1.52	18.29
14	1.096	1.60	2.22	12.34
15	.968	1.11	2.45	12.19
16	.989	1.25	1.71	12.90
17	1.010	1.46	2.02	16.19
18	1.196	1.28	1.46	17.98
19	1.063	1.21	2.13	13.13
20	1.066	1.63	1.49	14.40
21	1.118	1.06	1.22	16.07
22	1.030	1.30	.97	16.55
23	1.061	1.53	1.10	17.70
24	1.068	1.10	1.44	15.09
25	1.141	1.38	1.41	15.17
26	1.363	1.21	1.65	16.66
27	1.320	1.25	1.81	13.83
28	1.062	1.62	2.26	16.14
29	1.150	1.55	1.86	14.90
30	1.193	1.27	1.55	18.05
31	1.307	1.88	1.42	18.48

Compiled From
Original Record.

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

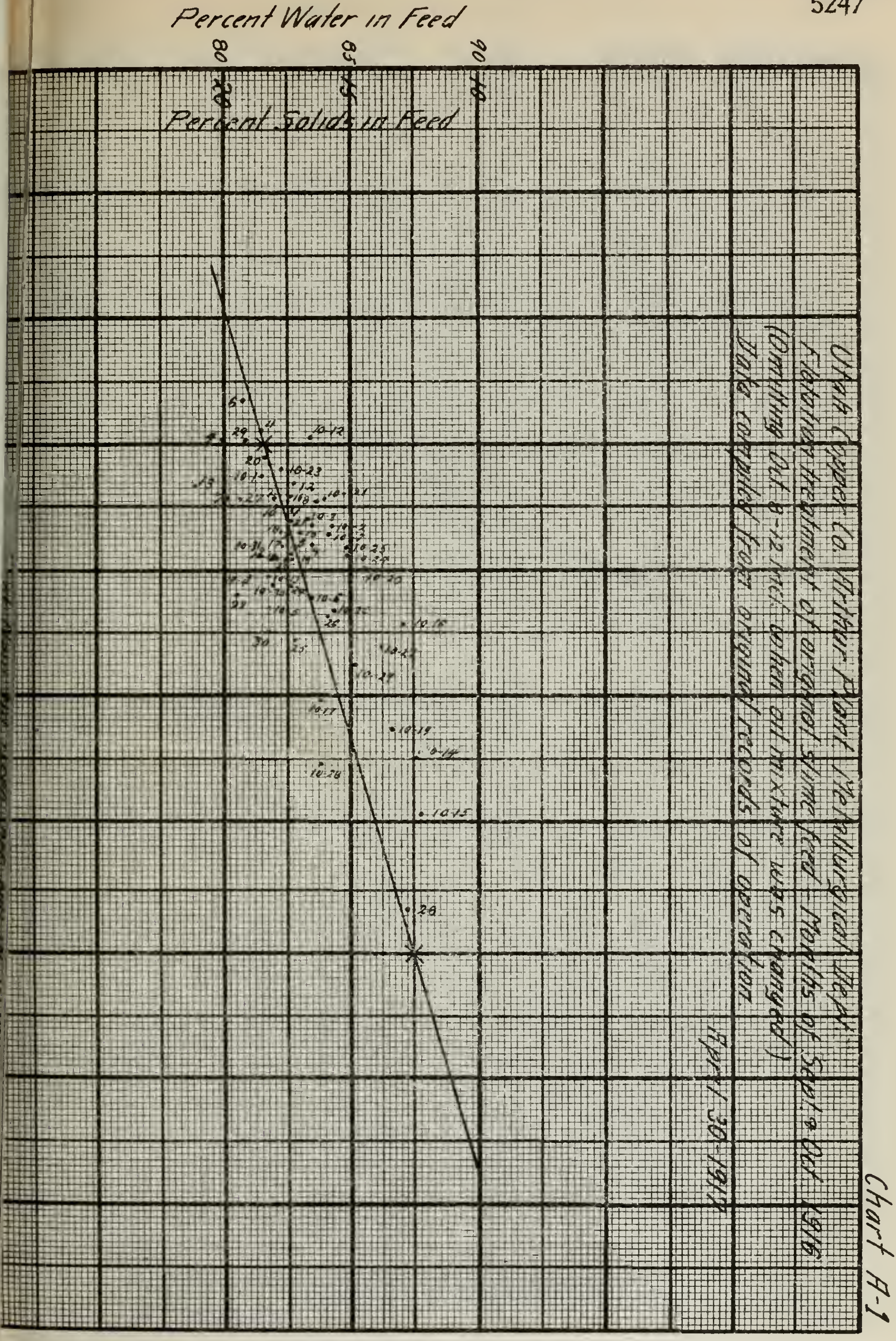
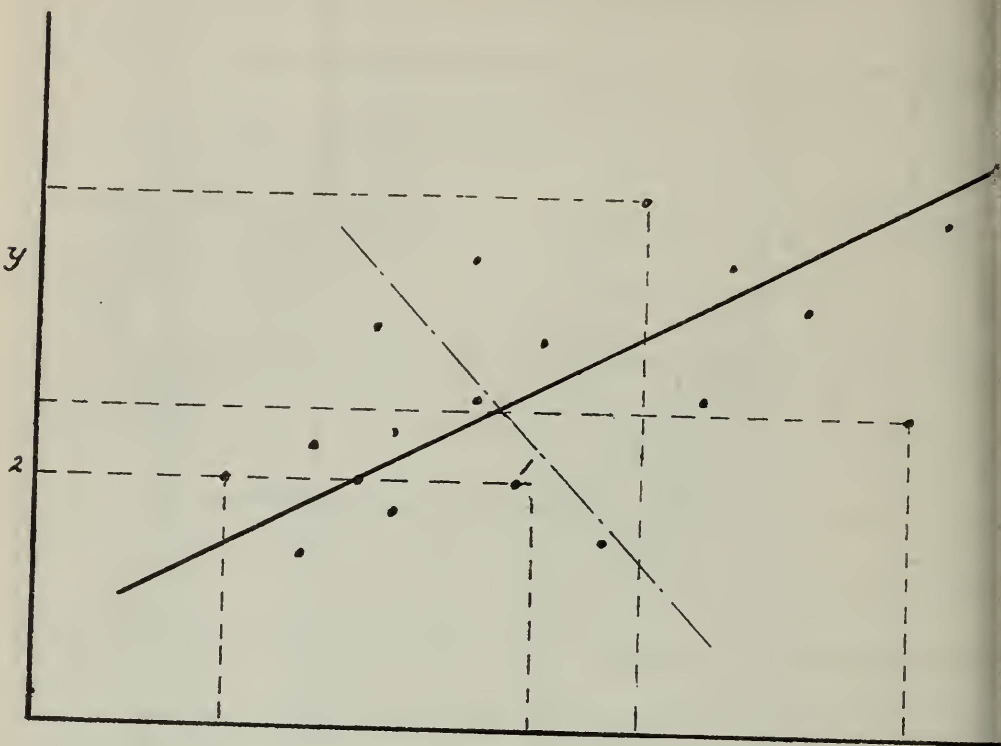

Percent Water in Feed
80
85
90
20
15
10
Percent Solids in Feed
Utah Copper Co. Arthur Plant / Metallurgical Dep't.
Flotation treatment of original slime feed - Months of Sept & Oct 1916
(Omitting Oct 8-12 incl. when oil mixture was changed)
Data compiled from original records of operation
April 30-1917
Chart A-1

DIAGRAM NO. 24 — DEF. EXHIBIT NO. 200—A.



$$y = Ax + B$$

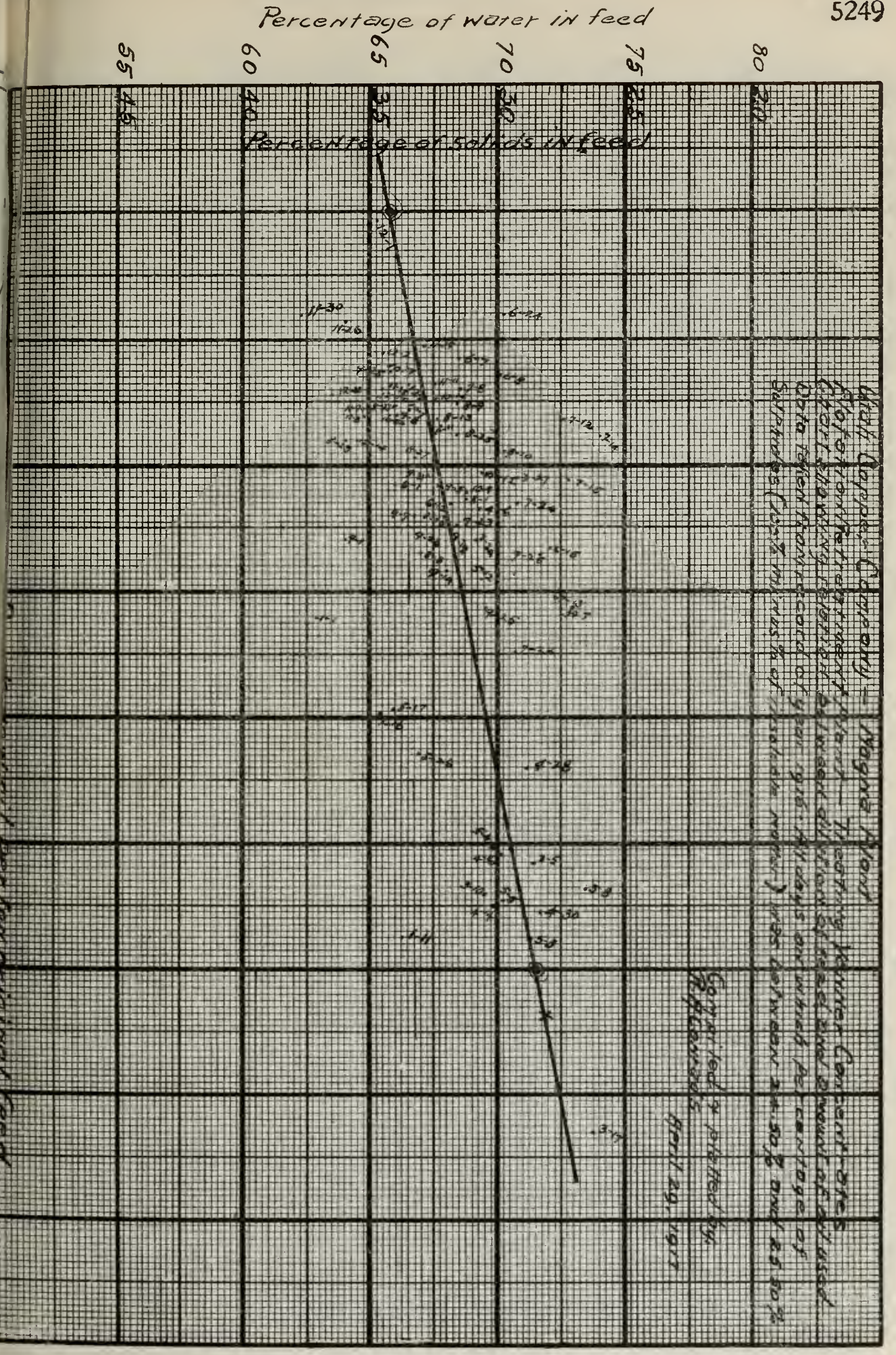
$$\begin{aligned} 2 &= 1A + B \\ 2.2 &= 3A + B \\ \hline 4.2 &= 4A + 2B \end{aligned}$$

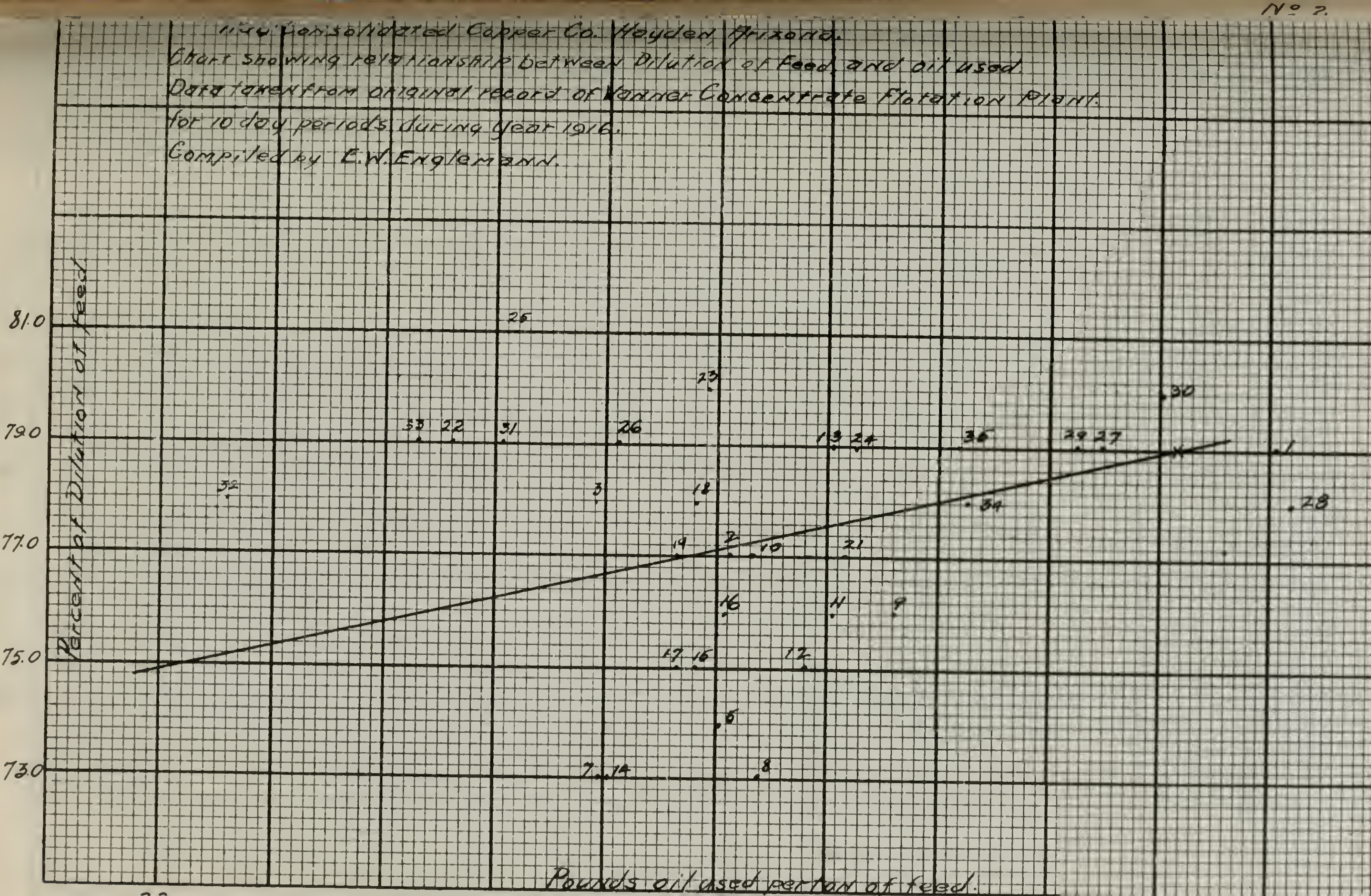
$$\begin{aligned} 4 &= 3.5A + B \\ 2.5 &= 5A + B \\ \hline 6.5 &= 8.5A + 2B \\ 4.2 &= 4A + 2B \\ \hline 2.3 &= 4.5A \end{aligned}$$

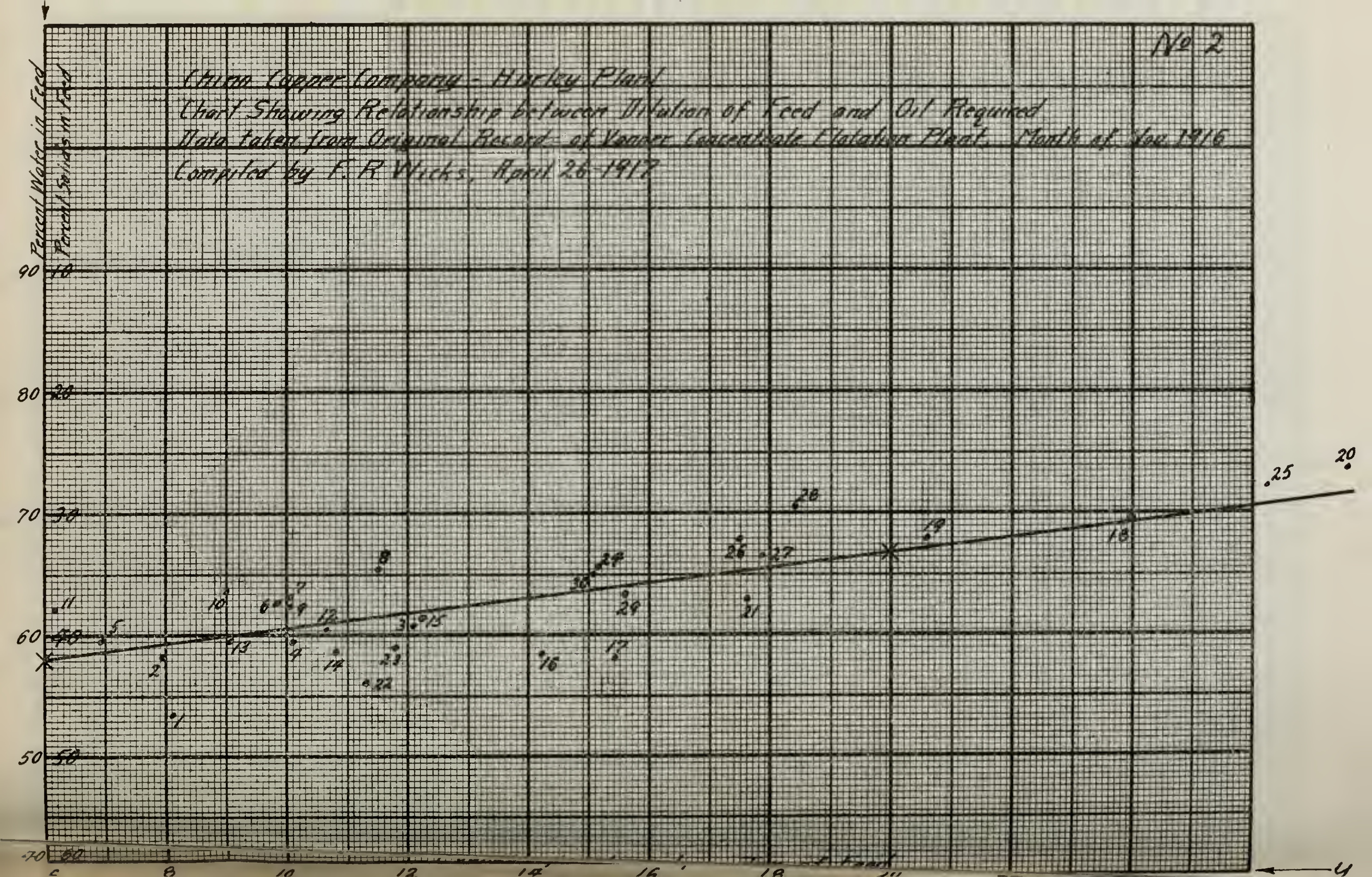
$$A = \frac{2.3}{4.5}$$

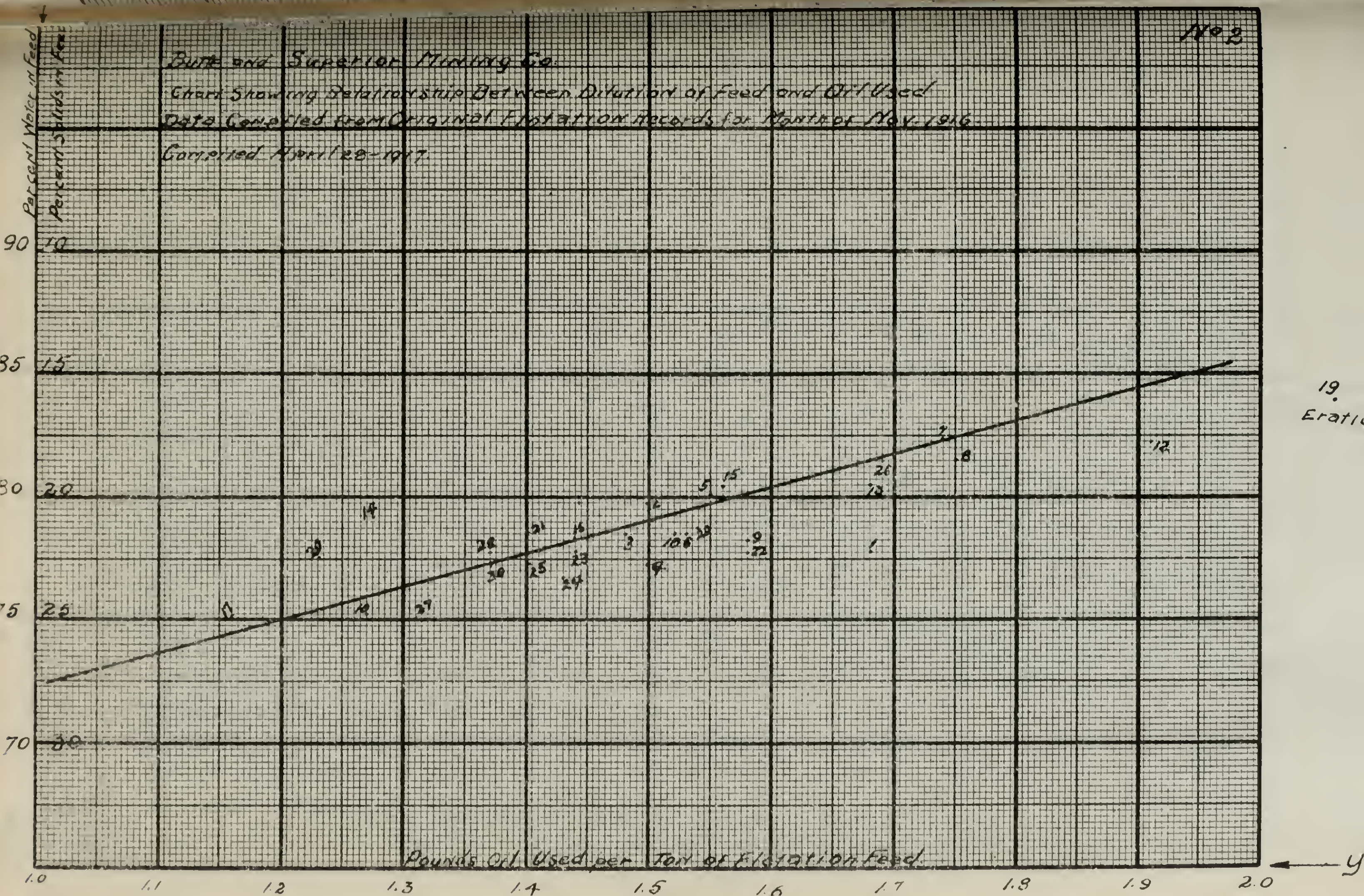
$$B = 1+$$

$$y = \frac{2.3}{4.5}x + 1+$$


Percentage of water in feed
55
60
65
70
75
80
45
40
35
30
25
20
Percentage of solids in feed
April 29, 1917


No. 2.
Consolidated Copper Co. Hayden Arizona.
Chart showing relationship between Dilution of feed and oil used.
Data taken from original record of Conner Concentrate Flotation Plant.
for 10 day periods during year 1916.
Compiled by E.W. Englemann.
Percent of Dilution of feed.
81.0
79.0
77.0
75.0
73.0
Pounds oil used per ton of feed.


No 2
Chino Copper Company - Hurley Plant
Chart Showing Relationship between Dilution of Feed and Oil Required
Data taken from Original Record of Vanner Concentrate Flotation Plant, Month of Nov 1916
Compiled by F. R. Wicks, April 26 1917
Percent Water in Feed
Percent Solids in Feed


No 2
Butte and Superior Mining Co.
Chart Showing Relationship Between Dilution of Feed and Oil Used
Data Compiled from Original Flotation Records for Month of Nov. 1916
Compiled April 28-1917
Percent Water in Feed
Percent Solids in Feed
Pounds Oil Used per Ton of Flotation Feed
90
85
80
75
70
10
15
20
25
30
1.0
1.1
1.2
1.3
1.4
1.5
1.6
1.7
1.8
1.9
2.0
19
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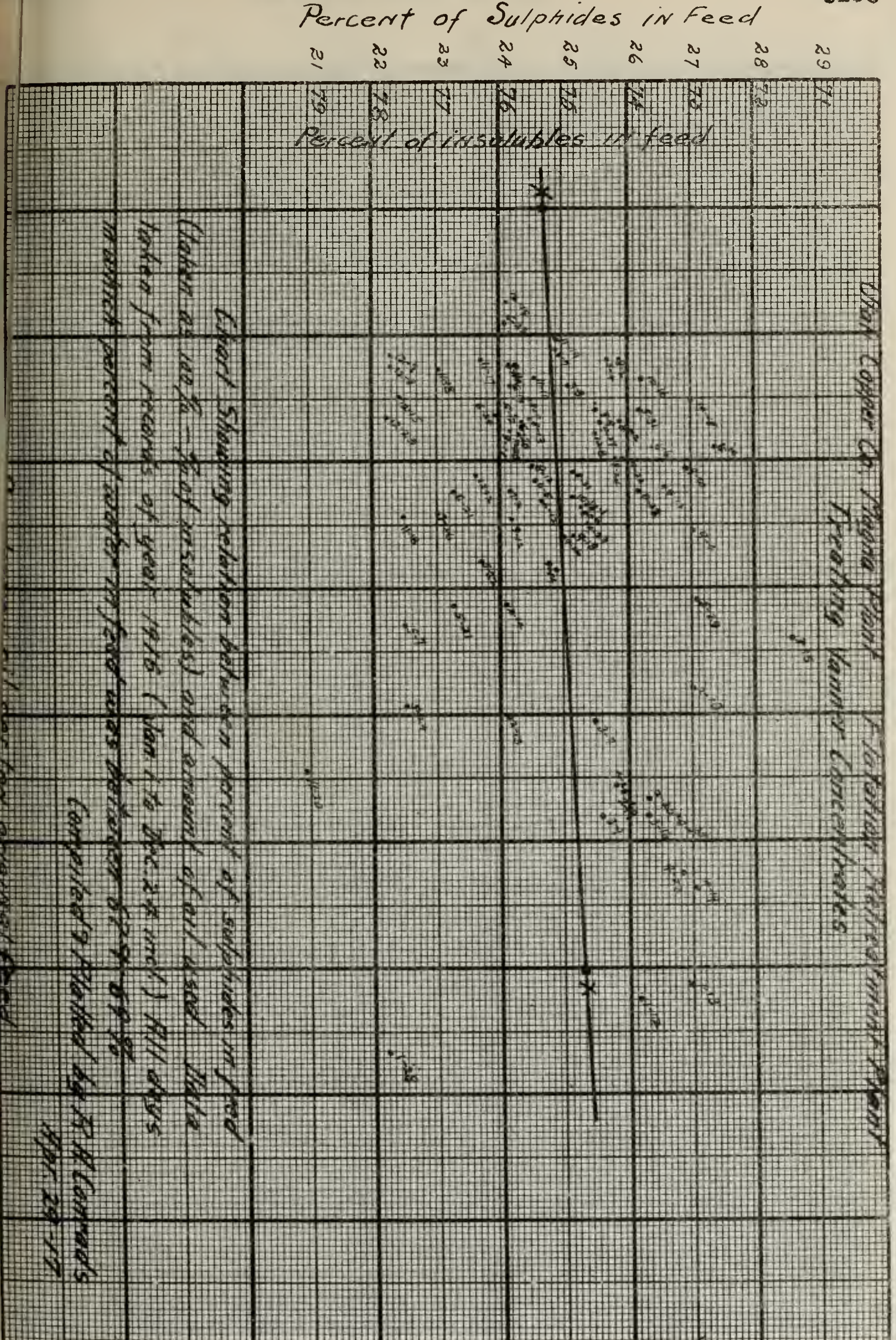
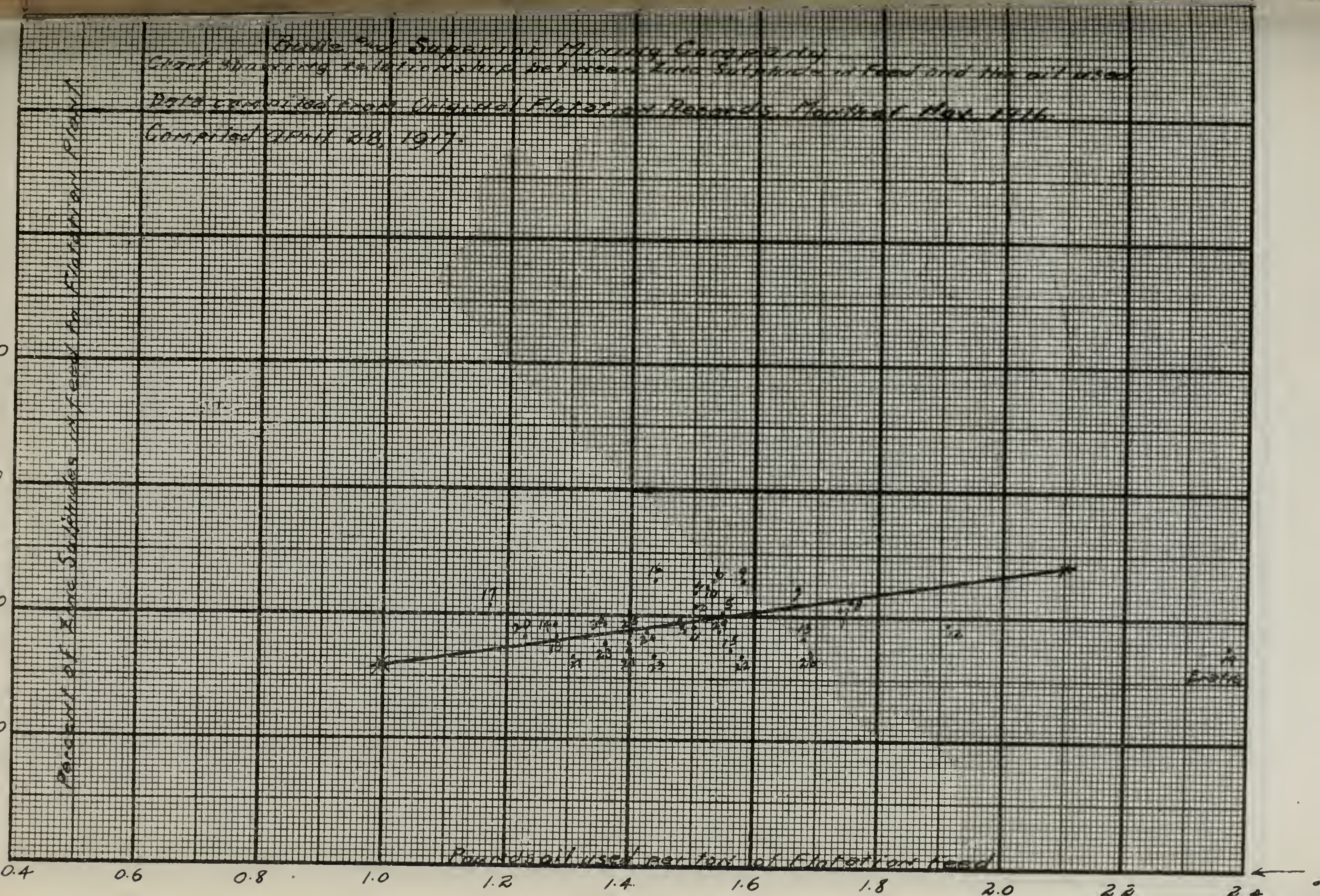
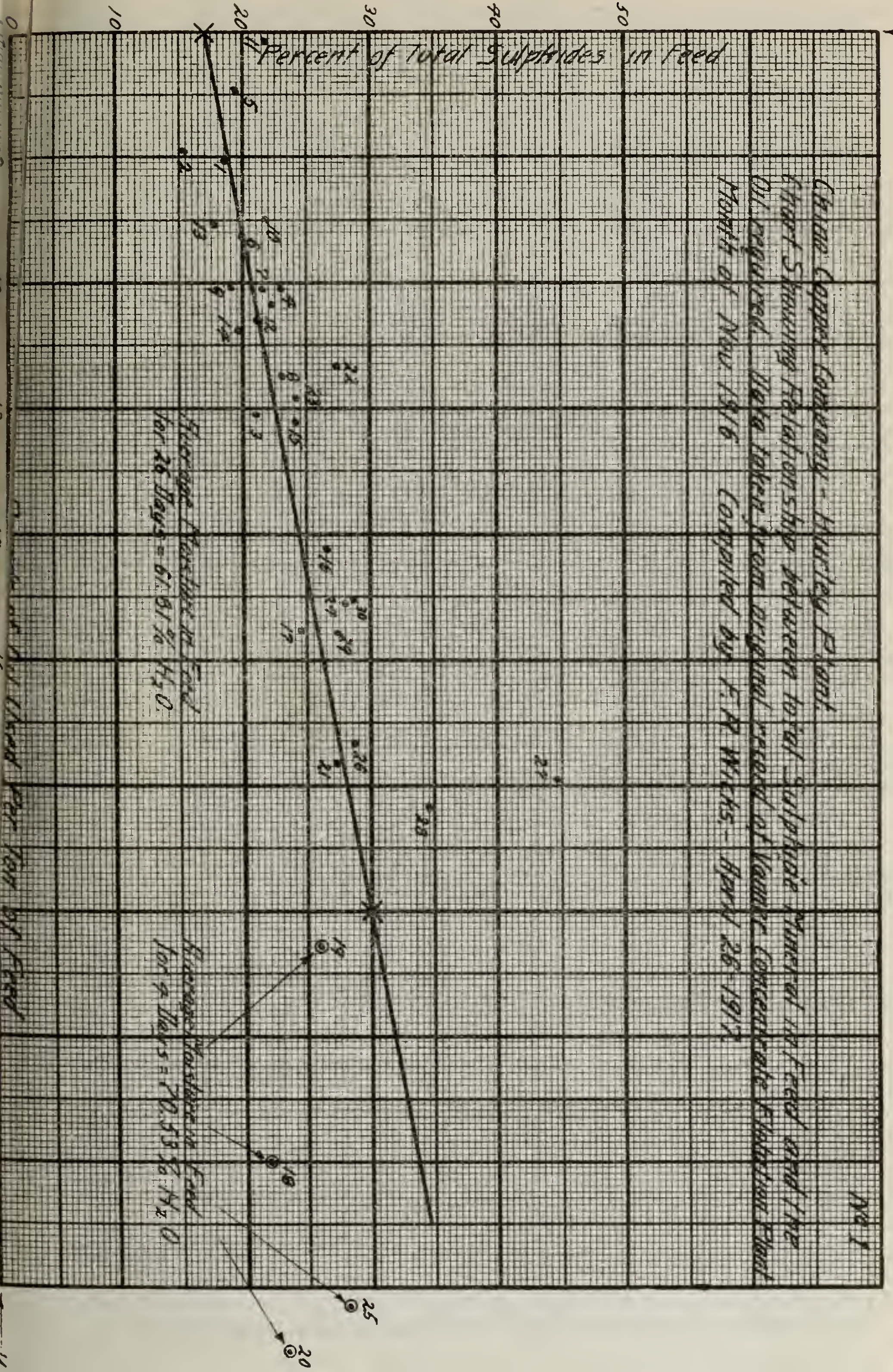
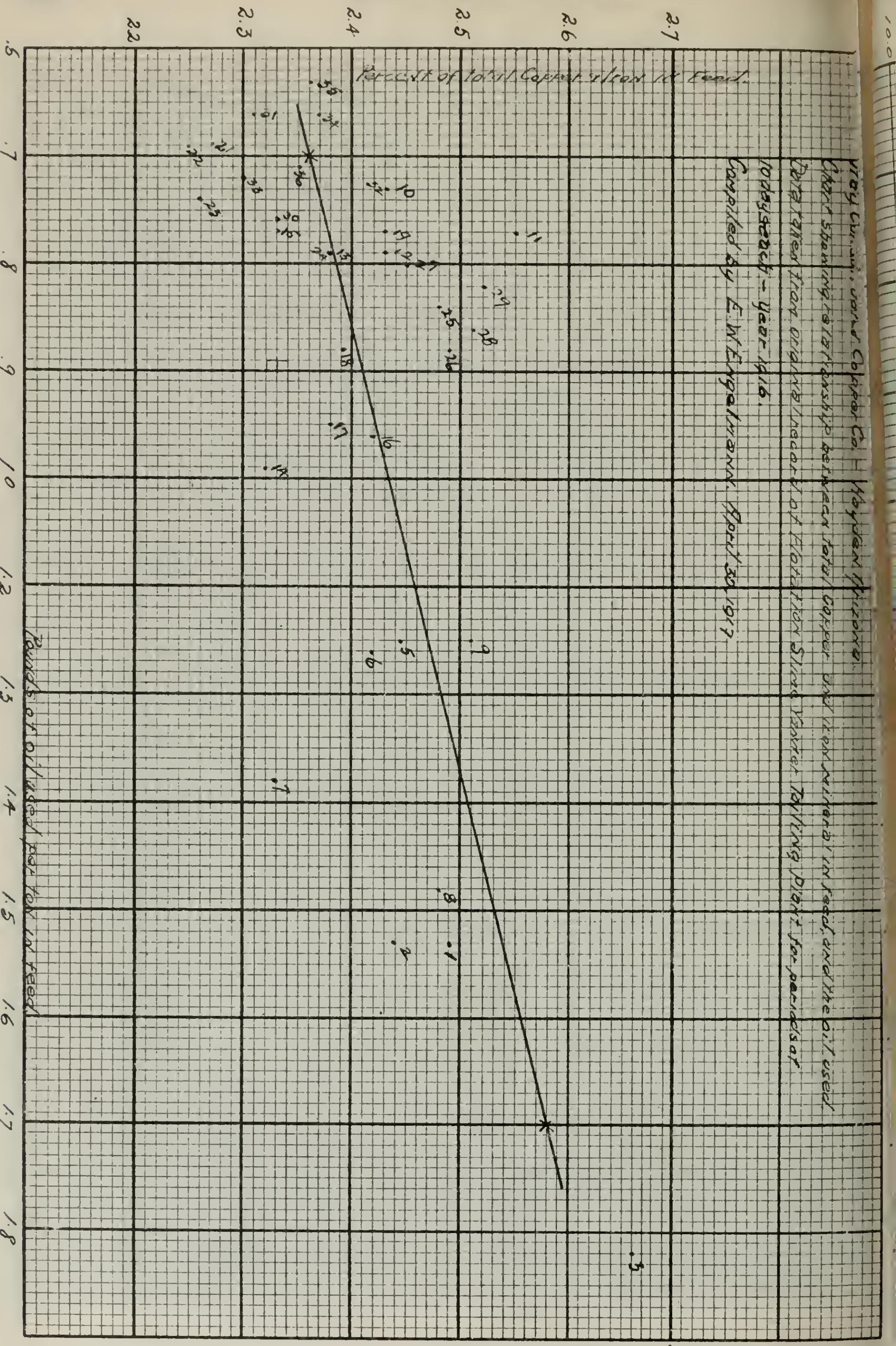
y

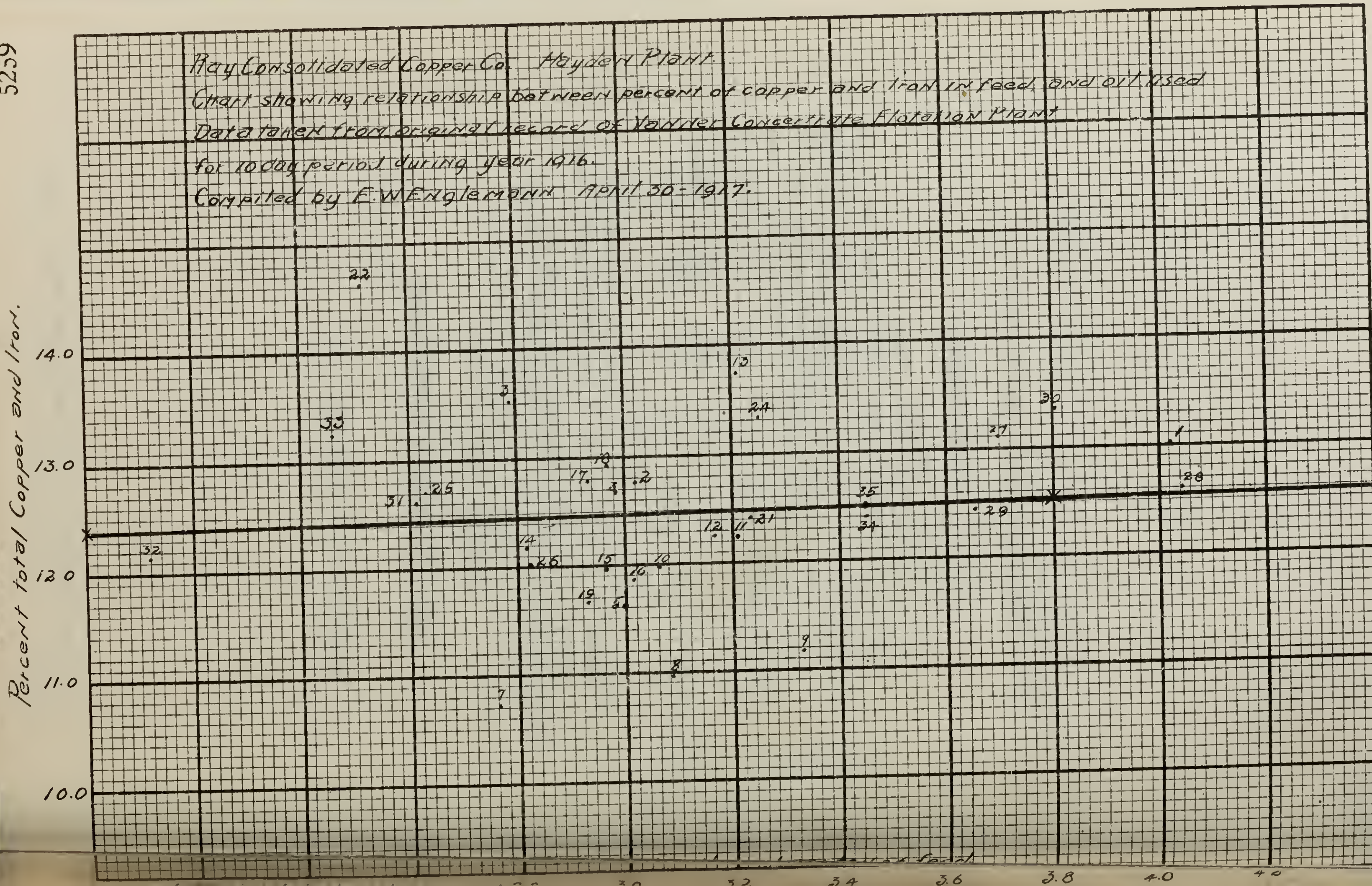

Percent of Sulphides in Feed
Percent of insolubles in feed
Utah Copper Co. Magna Plant Flotation Retreatment Plant
Treating Vanner Concentrates
Chart Showing relation between percent of sulphides in feed
(taken as 100% - % of insolubles) and amount of oil used. Data
taken from records of year 1916 (Jan 1 to Dec. 24 incl) All days
in which percent of water in feed was between 67% 69%
Compiled & Plotted by R. H. Conrads
Apr. 29-17


Superior Company
Compiled April 28, 1917.
40
30
20
10
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8
2.0


No 1
Chino Copper Company - Hurley Plant.
Chart Showing Relationship between total Sulphide Mineral in Feed and the Oil required. Data taken from original record of Vanner Concentrate Flotation Plant
Month of Nov. 1916 Compiled by F. R. Wicks.- April 26-1917.
Percent of Total Sulphides in Feed
Average Moisture in Feed for 26 Days = 61.81 % H_2O.
Average Moisture in Feed for 4 Days = 70.53 % H_2O
Per Ton of Feed
10
20
30
40
50
12
14
16


Compiled by E. W. Engelmann April 30, 1917
Pounds of oil used per ton in feed
2.2
2.3
2.4
2.5
2.6
2.7

No 1.



Ray Consolidated Copper Co. Hayden Plant.
Chart showing relationship between percent of copper and iron in feed, and oil used
Data taken from original record of Vanner Concentrate Flotation Plant
for 10 day period during year 1916.
Compiled by E. W. Englemann April 30-1917.
Percent total Copper and Iron.
10.0
11.0
12.0
13.0
14.0
3.4
3.6
3.8
4.0

Defendant's Exhibit No. 212.

UTAH COPPER COMPANY
ARTHUR PLANT

TEST NO. 1—MACHINE NO. 1—RETREATMENT PLANT
13 CELLS, FULL FEED, NO CIRCULATION

TEST PERFORMED 9:30 P. M. TO 10:30 P. M. APRIL 21, 1917.

		% COPPER					
	Tonnage	Total	Carb.	Sulphide	% Fe.	% Ins.	% Solids
Heading	10.1	4.700	.115	4.585			42.26
Tailing	7.1	.800	.045	.755			
Concentrate	3.0	14.150	.145	14.005	10.50	52.50	10.94

Ratio of concentration 3.42
Per cent indicated extraction (Total Cu) 87.95
Per cent indicated extraction (sulphide) 88.29
Pounds oil added 220
Pounds oil added per ton 21.78

Oils: 66% Smelter Fuel,
34% Jones

Reagent—Calura.

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Defendant's Exhibit No. 213.

Defendant's Exhibit No. 213

UTAH COPPER COMPANY
ARTHUR PLANT

TEST NO. 2—MACHINE NO. 1—RETREATMENT PLANT
13 CELLS, FULL FEED, NO CIRCULATION

TEST PERFORMED 7:45 TO 8:45 P. M. APRIL 21ST, 1917.

	Tonnage 24 Hrs.	% COPPER Total	Carb.	Sulphide	% Fe	% Insol.	% Solids
Heading	460	4.875	.060	4.815			42.00
Tailing	302	.462	.020	.440			20.29
Concentrate	158	13.300	.220	13.080	10.20	39.20	10.60

Ratio of concentration.. 2.91
Per cent indicated extraction (total Cu.).......................93.78
Per cent indicated extraction (sulphide)........................94.02

OIL ANALYSIS ON PRODUCTS

	Lbs. per ton
Tailing	23.16
Concentrate	491.80

OIL AND REAGENTS FOR TEST

Pounds oil added per ton............249.83

Oils: 59% Smelter Fuel
30% Jones
10% American Creosote No. 2
1% Yaryan Pine

Reagent—Calfura

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Defendant's Exhibit No. 214.

RAY CONSOLIDATED COPPER COMPANY
HAYDEN PLANT

Data Compiled From Monthly Statements (Form No. 62-R) Showing Results of Operation of Vanner Concentrate Retreatment Plant During Year 1916.

DIVIDED INTO 10-DAY PERIODS.

These Figures Submitted Below Consist of the Missing Periods as Shown by Similar Report Compiled by Me on April 30, 1917.

Period	Lbs. Oil Per Ton	% Water in Feed	ASSAY PLANT FEED % Copper	% Iron	% Total Cu. & Fe.
4	3.60	76.00	4.78	6.14	10.92
6	3.12	73.00	5.55	6.50	12.05
20	3.04	77.00	5.55	6.86	12.41
MISSING DATA FOR SLIME VANNER TAILING PLANT.					
4	1.50	80.00	.80	1.60	2.40
20	.66	73.00	.72	1.54	2.26

Respectfully submitted,
(Signed) E. W. ENGELMANN,
Flotation Eng'r Ray Con. Cu. Co.
Hayden, Arizona.

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Defendant's Exhibit No. 215.

URE'S DICTIONARY

OF

ARTS, MANUFACTURES, AND MINES

CONTAINING

A CLEAR EXPOSITION OF THEIR PRINCIPLES AND PRACTICE

EDITED BY ROBERT HUNT, F.R.S. F.S.S.

Keeper of Mining Records

Formerly Professor of Physics, Government School of Mines, &c. &c.

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LONGMAN, GREEN, LONGMAN, AND ROBERTS

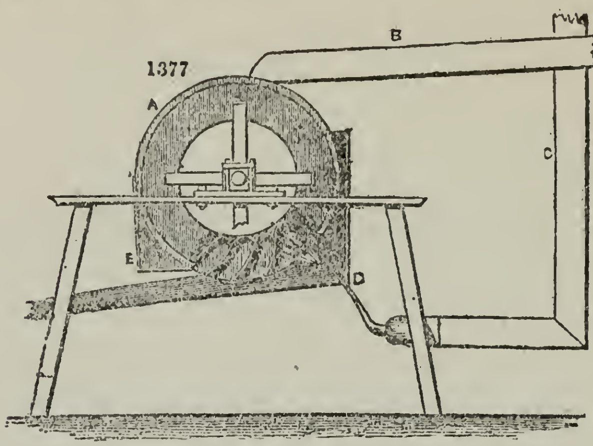
1860

331

tained from a pressure-column ten feet in height, and passes directly into the funnel, of a round buddle.

The wheel A, *fig.* 1377, is four feet in diameter, two feet six inches in breadth; has

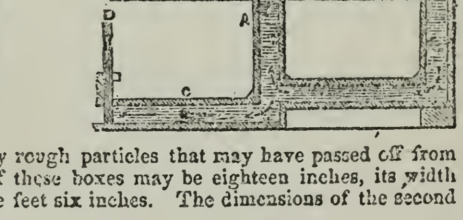
1377



twenty-four buckets, and makes five revolutions per minute; B, launder for supplying the finely-pulverized ore; C, pressure-column; D, jet-piece; E, launder for conveying off the slime overflow of the wheel; F, launder for conveying roughs to round buddle. A modification of this apparatus is employed at the Wildberg mines in Germany, where it has been recently introduced, and is found to succeed admirably for the classification of finely-divided ores.

Sizing cistern.—The tails from round buddles are sometimes passed through this apparatus. It consists, *fig.* 1378, of a wooden box provided with an opening at the bottom, A, which is in communication with a pressure-pipe, B, an outlet, C, and has a small regulating sluice, D. The stuff from the buddles enters at E, and the pressure in the column is so regulated as to allow the heavier particles of the stuff to descend, but at the same time to wash away at F the lighter matters that may be associated with the ore. This is done by having the outlet C of less area than the inlet, and fixing on the extremity D a convenient regulating sluice by which means a greater or less quantity of stuff may be passed over the depression F. Two cisterns of this kind are generally employed, the second being used to collect any rough particles that may have passed off from the first. The depth of the first of these boxes may be eighteen inches, its width thirteen inches, and its length three feet six inches. The dimensions of the second may be considerably less.

1378



The arrangement of another separating box is shown in *figs.* 1379 and 1380. The slime water flows in at M; and water still holding a considerable portion of slime flows away from the opposite end. It is necessary that pieces of chip, small lumps, or other extraneous matter should be intercepted previous to entering this apparatus, also that the slimes should be evenly sized by means of a trommel or sieve. The heaviest portion of the slime water in which the sand and ore is contained, is discharged at *o*, which is about an inch square. The launders *p p*, are for the purpose of conveying the slime water either to buddles or shaking tables. The dimensions of the cistern No. 1 are, length, six feet; width, one and a half feet; depth, twelve inches. But two other cisterns of similar form are attached. No. 1 cistern will work about ten tons of stuff in twenty-four hours, and by widening the box from eighteen to twenty-seven inches it will get through twenty tons in twenty-four hours. Affixed to one side of the boxes are hammers so contrived as to give thirty blows per minute in the

32

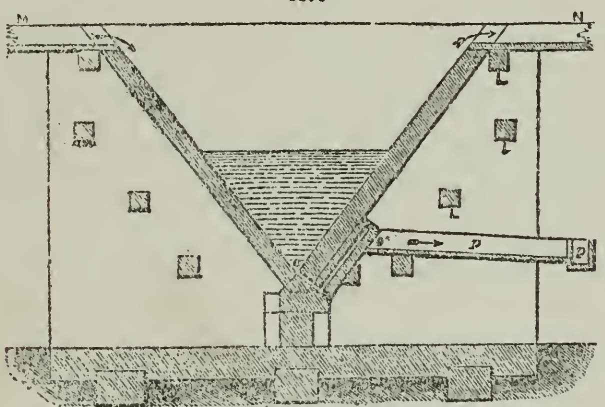
Defendant's Exhibit No. 215

ORES, DRESSING OF,

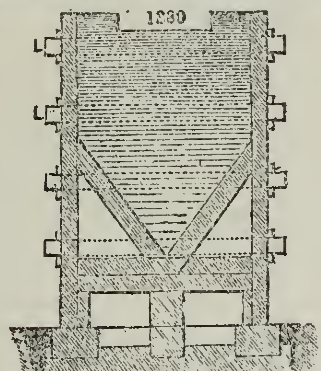
manner of a dolly tub. The sides of the box have an angle of fifty degrees from the horizontal. The chief dimensions of the two cisterns viz. one working ten and the other twenty tons, are subjoined.

No. of Box.	Ten tons.			Twenty tons.		
	Length of Box.	Breadth of Box.	Depth of Box.	Length of Box.	Breadth of Box.	Depth of Box.
	ft.	ft.	ft.	ft.	ft.	ft.
2	9	2	6	9	5	6
3	12	4	8	12	9	8
4	15	8	10	16	15	10

1379



1380



According to experiments made in the Stamping House of Schemnitz, where twelve tons are stamped in twenty-four hours, the first cistern separated from the slimes 40 per cent. of the ore; the 2nd cistern, 22 per cent.; the 3rd cistern, 20 per cent.; the 4th cistern, 12 per cent.; together, 94 per cent., leaving a loss of 6 per cent.

From No. 1 box every cubic foot of water flowing through gave 16 pounds of sandy matter. No. 2 afforded 13 pounds of finer stuff. No. 3, 16 pounds, and No. 4 yielded 12 pounds per cubic foot of water. It should be remarked that the outlet o is proportioned to the dimensions of the machine.

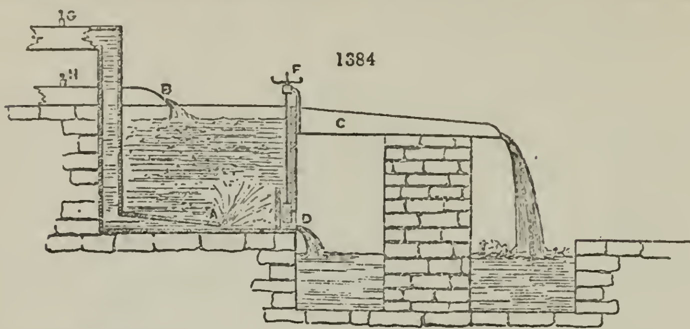
335

Defendant's Exhibit No. 215

ORES, DRESSING OF.

Wilkin's separator.—This apparatus is the invention of Mr. J. B. Wilkin of Wheal Bassett and Grylls, near Helston. He describes it as a "self-acting tossing

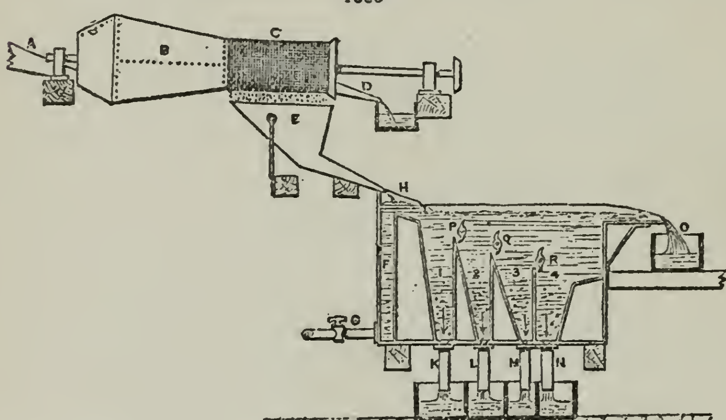
1384



machine, by which the rough particles are separated from the fine and prepared for the inclined plane. The orey matter is carried into a small cistern by a stream of water which enters at the top and passes out at the opposite side bearing the finer particles with it, whilst the rougher and heavier particles escape at the bottom through a rising jet of clean water, which prevents the fine and light particles from passing in the same direction." A, *fig.* 1384, inlet of clean water, B, launder delivering the orey matter, C, outlet of fine and inferior stuff, D, discharge orifice for rough and heavy stuff. This operation must be regulated by a flood-shut. A cistern 10 feet square on the top, and 18 inches deep will pass through about 40 tons in 10 hours. When separating stamps work a smaller cistern is employed, say 14 inches square, 10 inches deep, this will despatch 6 tons in 10 hours.

A valuable form of separator is shown in *fig.* 1385, the peculiarity of which consists

1385

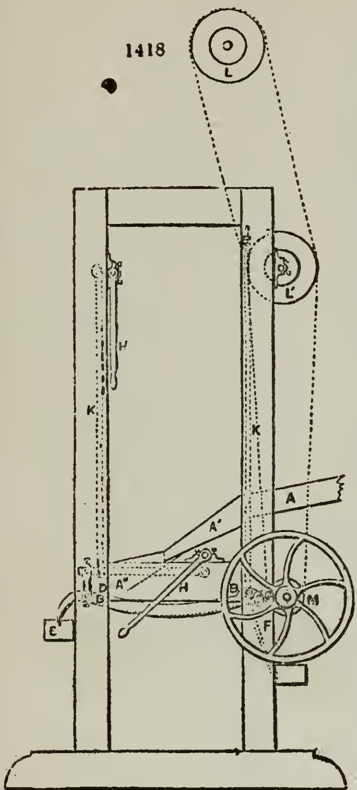


in the manner of introducing the water and slimes. Instead of the latter depending for separation upon the power of an ascending column of water, it here passes into a horizontal flow of greater or less volume and velocity, produced by altering the tap G. Compartments, viz. 1, 2, 3 and 4, are also fitted in the box, for the purpose of receiving mineral of different densities and size, which is discharged and washed in strips set underneath; A, inlet launder to trommel; B, waist of sheet iron; C, trommel either of perforated plate, or wire gauze; D, shoot from trommel serving to convey away the rougher portions; E, hopper for conveying stuff to shoot H, and from thence into the box; F, ascending column of water; G, tap for regulating the flow of water; K, L, M, N, outlet pipes for delivering the separated stuff to strips or buddles; O, launder for receiving overflow from cistern; P, Q, R, valves regulating the width of the compartments, also for the purpose of effecting the disposition of the different minerals with which the ore may be associated.

Defendant's Exhibit No. 215

frame n. The slime box A″ is perforated at D with numerous holes, each of which is fitted with small regulating pins.

1418



The table B B is 2 feet 2 inches wide, and 2 feet 10 inches long, with a bottom formed of copper gauze. It is suspended by the vertical rods K K, and varying degrees of inclination are given to the table by altering the levers H H. For the purpose of quickening or decreasing the action of the table two cones are employed, L L′, upon which the driving band is shifted as may be necessary. A band from a runner, fitted on the axis of the cone L, communicates motion to a pulley wheel, M, upon the shaft of which are cranks attached to connecting rods G, giving motion to the table.

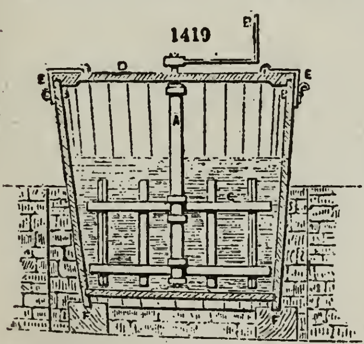
When the machine is in operation, the ore flows over at F, into the launder beneath it, whilst the waste is carried over the opposite end into the trough E.

Professor B. Silliman, jun., and Mr. J. D. Whitney give the following particulars of results realised by this machine:—The total weight of ore stuff dressed during 122 days was 11,948,900 pounds of rock stamped and crushed, or 5,080 tons miners' weight.

The total ore sold from this quantity of stuff was 128 gross tons (2352 lbs.), or $2\frac{51}{100}$ per cent. of the stuff worked over. By the Captain's vans the average richness of the stamp work (forming much the larger part of what goes to the separators) for 22 weeks was 2·32 per cent. The humid assay of the average work from the stamps for five weeks in July and August, gave for the richness of the stuff dressed on the separators 3·28 per cent. of ore, or ·984 per cent. of metallic copper. There is, therefore, an apparent loss in the tailings of $\frac{77}{100}$ per cent. of 30 per cent. ore, or $\frac{23}{100}$ of copper. The amount of ore, however, lost in the tailings does not exceed $\frac{5}{10}$ to $\frac{6}{10}$ per cent., or about $\frac{15}{100}$ per cent. of copper. The actual products of working, therefore, as may be seen, exceed for the machines the average richness of the Captain's vans.

Of the total ore produced in this time, 181,126 pounds came from the separators, and 160,858 pounds from the jiggers. The whole amount of stuff therefore required to produce this amount of ore, estimated from the above ratio (1·15 : 1) is 768,680 pounds. This may be taken approximately as the actual quantity which passed over the separators, and if calculated on the Captain's vans, it should have produced 177,961 pounds of ore, while in fact it did produce 181,126 pounds, or a variation in excess for the machines of only 3,210 pounds. Each of the separators therefore dresses about $1\frac{1}{2}$ tons of rock daily, of stuff yielding an average of 2·5 per cent. of 30 per cent. ore.

1419



Dolly tub or packing kieve.—This apparatus is employed for the purpose of excluding fine refuse from slime ore, which has been rendered nearly pure by previous mechanical treatment. In using it the workmen proceed thus:—The kieve, *fig.* 1419, is filled to a certain height with water, and the dolly A introduced. A couple of men then take hold of the handle D, and turning it rapidly cause the water to assume a circular motion. The tossing is then

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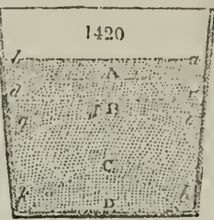
Defendant's Exhibit No. 215

ORES, DRESSING OF.

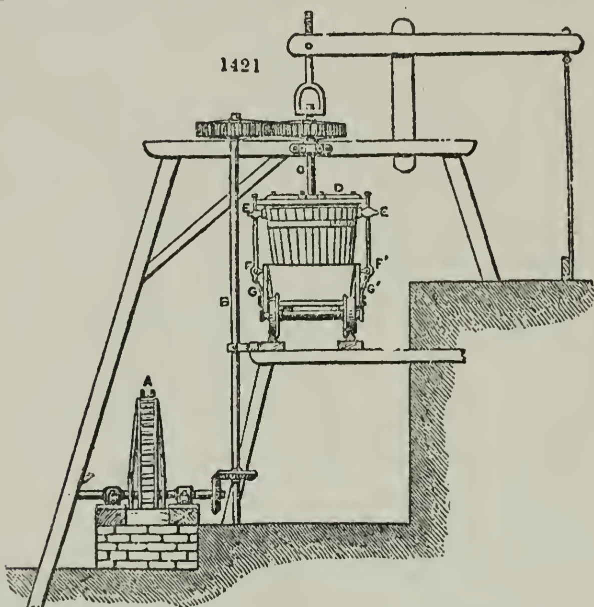
commenced by shovelling in the slime until the water is rendered somewhat thick. After continuing the stirring for a short period, the hasps E E are loosened, and the bar D with the dolly are suddenly withdrawn. The tub is then packed by striking its outside with heavy wooden mallets. When this operation is terminated, the water is poured off through plug-holes in the side of the tub.



The object of the rotary motion created by the dolly is to scour off clayey or other matter adhering to the ore, whilst the packing hastens the subsidence of the denser portions. In one operation of this kind four distinct strata may be procured, as indicated by the lines *a b*, *c d*, *e f g*, *h c k*, in *fig.* 1420.

The upper portion, viz. from A to B, will probably have to be set aside for further washing, whilst the schlich C should be fit for market. The conical nucleus in the centre of the tub generally consists of coarse sand, and is usually further enriched on a copper bottom sieve, or else submitted to the action of a tye, or other suitable apparatus.

Machine dolly tub. — This kieve is packed by machinery represented in the accompanying woodcut, in which A is a small water-wheel working a vertical shaft B, and driving another shaft O. At the bottom of this is fixed a notched wheel D, which



presses outwardly the hammers E E; these are mounted upon iron bars F F', and violently driven upon the side of the kieve by means of springs G G'.

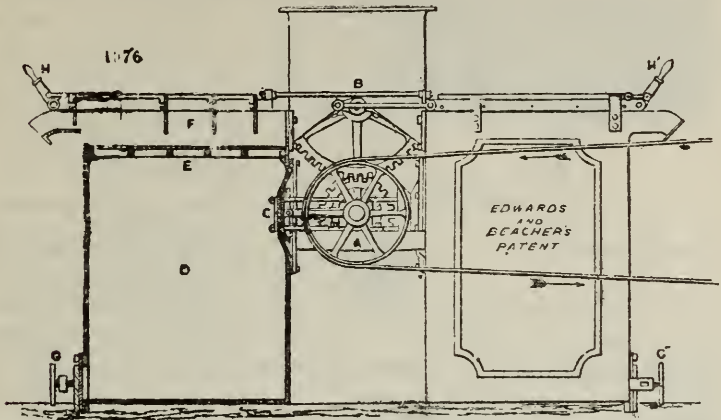
The degree to which ore can be concentrated by dollying must evidently depend upon several conditions: — 1st. The initial percentage of the ore. 2nd. The condition to which it is reduced. 3rd. The matrix with which it is associated. 4th. The proportion of water employed. And lastly, if the rotation and packing have been judiciously performed. An experiment upon some sandschlich lead ore, much intermixed with fine carbonate of iron, gave the following results: —

Introduced into dolly tub, 17 cwt., assayed, 48%.		
Time required to introduce stuff - - - - - -	6	minutes.
Dolly rotated - - - - - - - - - -	5	„
Dolly withdrawn —		
Tub packed - - - - - - - - - - -	5	„
Running off water - - - - - - - - -	6	„
Skimming and cleaning out tub - - - - - -	20	„
Total -	42	

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

B, which is driven at a slower rate by means of toothed wheels, and gives by cranks or eccentrics, a horizontal motion backwards and forwards to sets of scrapers F, above

1376



the cisterns. These are so arranged as to remove the upper stratum of the substance being acted upon, and discharge it into waggons or other convenient receptacles; these upper strata are of course the lightest, the heavier part settling upon the perforated plates below.

When from the action of the machine a considerable quantity of material has accumulated upon these plates, the scrapers are thrown out of gear by means of apparatus attached, H H, and the stuff raked off, the operation being then continued on fresh supplies. Doors, G G, at the bottom of the machines admit of any fine stuff which may pass through the perforated plates being removed from time to time as may be necessary.

These machines are in use for cleansing coal as well as other mineral substances. In such cases the heavier stuff which remains upon the plates consists of shale, pyrites, &c., very injurious substances in the manufacture of coke. One machine of two connected cisterns, is capable of washing about thirty tons per diem of coal, but the quantity of mineral work will depend upon the amount of ore present in proportion to the waste. The size of the perforations in the screens is adapted to the quality of the material acted upon.

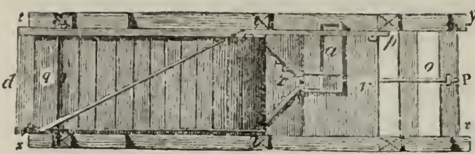
gold washing machine has been arranged by Mr. John Hunt, late of Pont-Pean, France. This gentleman states that it requires but little water, and is so contrived, as to circulate this water for repeated use; also that the principle would be found very successful if employed on a more extended scale; this Mr. Hunt intends to carry into operation at some lead mines in Cornwall

Separators

Of late years apparatus of this class has been steadily coming into operation, not only in lead and copper mines, but also in the dressing of tin ores. The prevailing principle is that of directing a pressure of water against the density of the descending material, making the former sufficiently powerful to float off certain minerals with which the ore may happen to be associated. When marked difference of densities exist, and the ore can be readily freed from its gangue, this mode of separation will be found effective. Trommels may be advantageously employed for sizing the stuff previous to its entry into the several separators.

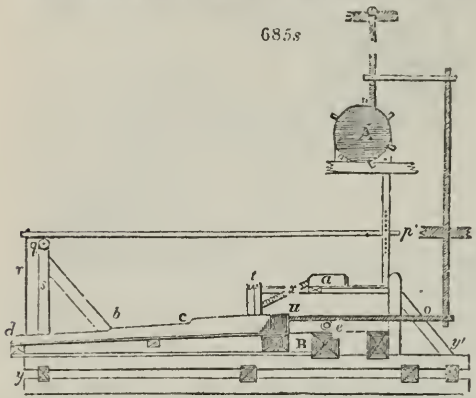
Slime separator.—This apparatus is due to Captain Isaac Richards, of Devon Great Consols, and is employed for removing the slime from the finely-divided ores which have passed through a series of sieves set in motion by the crusher. The finely-divided ores are for this purpose conveyed by means of a launder upon a small water-wheel, thereby imparting to it a slow rotary motion. Whilst this is turning time is allowed for the particles to settle in accordance with their several densities; the result obtained is that the heavier and coarser grains are found at the bottom of the buckets, whilst the lighter and finer matters held in suspension are poured out of the buckets and flow away through a launder provided for that purpose. The stuff remaining in the bottom of the buckets is washed out by means of jets of water ob-

685*r*



This machine was in constant use at the Great Polgooth Mine for some time, and it is said effected a saving of 30 per cent. in the dressing of slime ore. It is not so well adapted for rough as for the treatment of fine slimes; the apparatus may be managed by a boy at 8*d.* per day, and the cost of the machine complete is about 60*l.*

685*s*

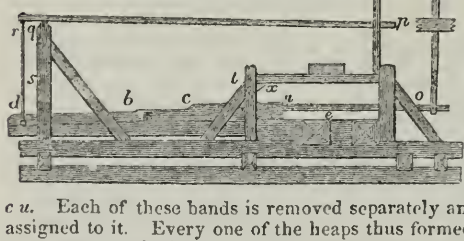


Percussion table or Stossheerd. — The diagrams, *figs.* 685*r*, 685*s*, and 685*t*, exhibit a plan, vertical section, and elevation of one of these tables, used in the Harz. The *arbor* or great shaft, is shown in section perpendicularly to its axis, at A. The *cams* or wipers are shown round its circumference, one of them having just acted on *n*.

These cams, by the revolution of the arbor, cause the alternating movements of a horizontal bar of wood, *o*, *v*, which strikes at the point *u* against a table *d*, *b*, *c*, *u*. This table is suspended by two chains *t*, at its superior end, and by two rods at its lower end. After having been pushed by the piece, *o*, *u*, it rebounds to strike against a block or bracket B. A lever *p*, *q*, serves to adjust the inclination of the movable table, the pivots *q* being points of suspension.

The stuff to be washed, is placed in the chest *a*, into which a current of water runs. The ore, floated onwards by the water, is carried through a sieve on a small sloping table *x*, under which is concealed the higher end of the movable table *d*, *b*, *c*, *u*; and it thence falls on this table, diffusing itself uniformly over its surface. The particles deposited on this table form an oblong *talus* (slope) upon it; the successive percussions that it receives, determine the weightier matters, and consequently those richest in metal, to accumulate towards its upper end at *u*. Now the workman by means of the lever *p*, raises the lower end *d* a little in order to preserve the same degree of inclination to the surface on which the deposit is strewed. According as the substances are swept along by the water, he is careful to remove them from the middle of the table towards the top, by means of a wooden rake. With this intent, he walks on the table *d b c u*, where the sandy sediment has sufficient consistence to bear him. When the table is abundantly charged with the washed ore, the deposit is divided into three bands or segments *d b*, *b c*, *c u*. Each of these bands is removed separately and thrown into the particular heap assigned to it. Every one of the heaps thus formed becomes afterwards the object of a separate manipulation on a percussion table, but always according to the same procedure. It is sufficient in general to pass twice over this table the matters contained in the heap, proceeding from the superior band *c u*, in order to obtain a pure *schlich*; but the heap proceeding from the intermediate belt *b c*, requires always a greater number of manipulations, and the lower band *d b* still more. These successive manipulations are so associated that eventually each heap furnishes pure *schlich*, which is

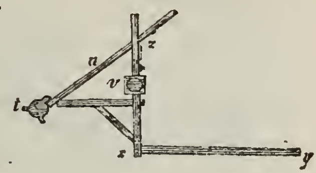
685*t*



obtained from the superior band *c u*. As to the lightest particles which the water sweeps away beyond the lower end of the percussion table, they fall into launders, whence they are removed to undergo a new manipulation.

Fig. 1413 is a profile of a plan which has been advantageously substituted, in the Harz, for that part of the preceding apparatus which causes the jolt of the piece *o u* against the table *d b c u*. By means of this plan, it is easy to vary, according to the circumstances of a manipulation always delicate, the force of percussion which a bar *x y*, ought to communicate by its extremity *y*. With this view a slender piece of wood *u* is made to slide in an upright piece, *v x*, adjusted upon an axis at *v*. To the piece *u* a rod of iron is connected, by means of a hinge *z*; this rod is capable of entering more or less into a case or sheath in the middle of the piece *v x*, and of being stopped at the proper point, by a thumb-screw which presses against this piece. If it be wished to increase the force of percussion, we must lower the point *z*; if to diminish it, we must raise it. In the first case, the extremity of the piece *u*, advances so much further under the cam of the driving shaft *t*; in the second, it goes so much less forwards; thus the adjustment is produced.

1413



The water for washing the ores is sometimes spread in slender streamlets, sometimes in a full body, so as to let two cubic feet escape per minute. The number of shocks communicated per minute, varies from 15 to 36; and the table may be pushed out of its settled position at one time three quarters of an inch, at another nearly 8 inches. The coarse ore-sand requires in general less water, and less slope of table, than the fine and pasty sand.

The following remarks on the Freiberg *shaking table*, are by Mr. Upfield Green, of the Wildberg Mines, Prussia. The bed of the table is about fourteen feet long, by six feet wide, and is formed of double one-inch boards, fastened to a stout frame. The table is hung by four chains, the two hindermost are generally two feet long with an inclination of 2 to 4 inches. The two front ones, which are attached to a roller for the purpose of altering the inclination of the table, are five feet six inches long, and hang perpendicularly when the table is at rest.

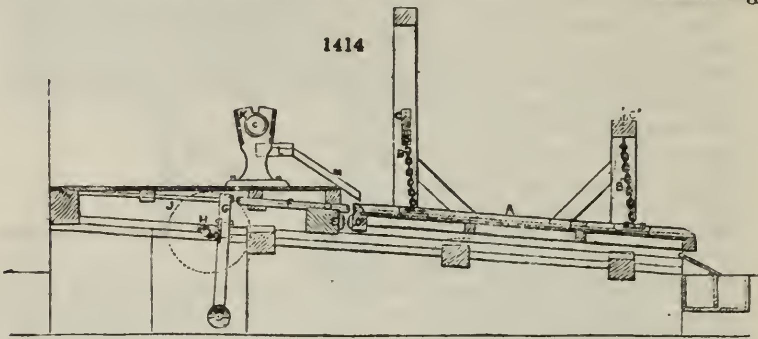
The table receives its action from cams inserted in the axle of a water-wheel, acting on the knee of a bent lever. The slimes after being thoroughly stirred up by a tormentor, are conveyed by a launder in a box, where they are still further diluted with clean water, and passing through a sieve with apertures corresponding to the size of the grain to be dressed, flow upon an inclined plane furnished with diffusing buttons, and from thence drip on to the shaking table.

In treating rough slimes the two hindermost chains are set at an inclination of 5 to 6 inches, and the table with an inclination of 4 to 6 inches on its length, makes 36 to 39 pulsations of 5 to 6 inches in length per minute. About $2\frac{1}{2}$ cubic feet of diluted slimes, twelve of clean to one of slime-water, enter the table per minute.

Before commencing the percussive action, the table is covered with a thin layer of rough slimes, and during the first few minutes only clean water is admitted. In consequence of the quantity of water and violent motion employed, the smaller and lighter particles of ore are likely to drift down the table, and a rake is therefore employed at intervals to reconvey such particles towards the head of the table. Care must, however, be taken not to allow the water to wear furrows in the deposit. From two to three hours are usually required for the roughest sand-slimes to deposit four to five inches on the head of the table. The crops are twice more passed over the shaking table and afterwards dollied. The rapidity of movement and quantity of clean water increase with each operation. The tails of the first operation, which are considerably poorer than the original stuff, may be either thrown away, or once more passed over the table, when the crop will be fit for treatment along with a fresh quantity of original slime. The treatment of fine slimes is similar to that of the rough, with the exception that the inclination of the table, quantity of slime-water, proportion of clean water, and length of stroke, constantly decrease with the degree of fineness of the slime; and the number of strokes increase in proportion. In fact, for the finest slimes, the table has no greater inclination than one inch on its whole length, while the stroke, of which 35 to 45 per minute are made, is no longer than $\frac{1}{4}$ to $\frac{1}{2}$ an inch. The time required for dressing varies with the nature of the slime operated on, five tons of rough slimes occupies sixty-eight hours, whilst the same quantity of very fine slimes requires no less than four times that period.

The Stossheerde.—To the kindness of Mr. Charles Remfry, of Stolberg, I am indebted for the elevation of a stossheerd erected at the Breinigerberg Mines, under his management. It has the merit of being extremely light, requiring little power, and of performing its work in a highly satisfactory manner. *Fig.* 1414, A, table swung

1414



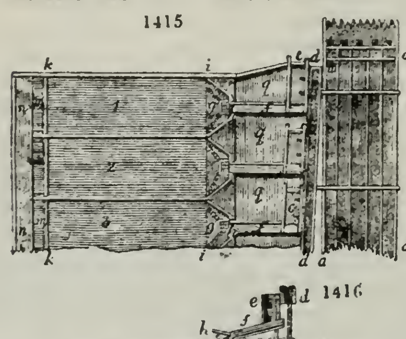
by chains, B B′, its width being 3 feet and length 12 feet. A greater or less inclination is given to the table by raising or lowering the screws C C′. At the upper end of the table is a buffer, D, which acts against a counter buffer, E. A sliding bar, F, is also fitted between the table and percussion lever G. This lever is struck by cams fitted on the axis H, driven by the runner J. The slimes to be treated flow into the cistern K, 30 inches long, 13 inches wide, and 18 inches deep. Into this box a tormentor, is introduced for the purpose of breaking up the slimes. The bottom is fitted with a launder, L, 7 inches long, and 5 inches wide. From this launder proceeds a head-board, M, expanded to the width of the table, and fitted with buttons, for the purpose of dispersing the slimes equally on the head of the table.

At the Breinigerberg mines the slimes are very fine and tough, and not rich in metal. With the round buddle unimportant results were obtained; but the stossheerd concentrated them satisfactorily. About five tons of rough slime are enriched per day on four tables, whilst from nine to ten tons of the enriched slime are despatched in a similar period.

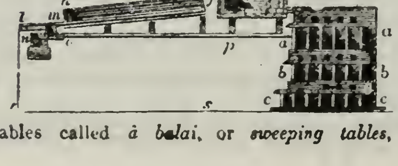
The four tables are managed by two boys, at a cost of 1*s.* 2*d.* per day. The cost of these machines complete, including water-wheel, 9 feet diameter, and 3 feet in breast, was 114*l.*

Sleeping tables. — *Figs* 1415, 1416, represent a complete system of *sleeping tables*, *tables dormantes*, such as are mounted at Idria. *Fig.* 1415 is the plan, and *fig.* 1416 a vertical section. The ores, reduced to a sand by stamps, pass into a series of conduits, *a a*, *b b*, *c c*, which form three successive floors below the level of the floor of the works. The sand taken out of these conduits is thrown into the cells *q*; whence they are transferred into the trough *e*, and water is run upon them by turning two stop-cocks for each trough. The sand thus diffused upon each table, runs off with the water by a groove *f*, comes upon a sieve *h*, and spreads itself upon the board *g*, and thence falls into the slanting chest or sleeping table *i k*. The under surface *k* of this chest, is pierced with holes, which may be stopped at pleasure with wooden plugs. There is a conduit *m*, at the lower end of each table to catch the light particles carried off by the water out of the chest *i k*, through the holes properly opened, while the denser parts are deposited upon the bottom of the chest. A general conduit *n*, passes across at the foot of all the chests, *i k*, and receives the refuse of the washing operations.

1415



1416



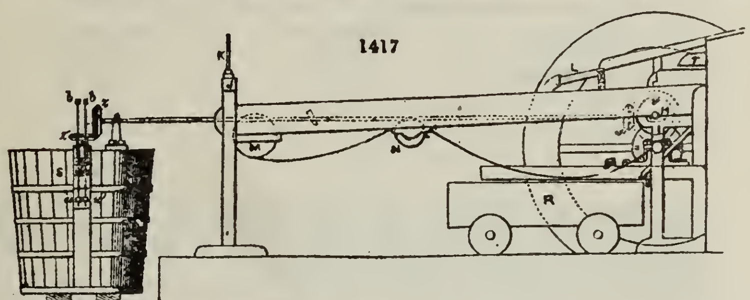
In certain mines of the Harz, tables called *à balai*, or *sweeping tables*, are employed. The whole of the process consists in letting flow, over the sloping table; in successive currents, water charged with the ore, which is deposited at a less or greater distance, as also pure water for the purpose of washing the deposited ore, afterwards carried off by means of this operation.

At the upper end of these *sweeping-tables*, the matters for washing are agitated in a chest, by a small wheel with vanes, or flap-boards The conduit of the muddy waters opens above a little table or shelf; the conduit of pure water, which adjoins the preceding, opens below it. At the lower part of each of these tables, there is a transverse slit, covered by a small door with hinges, opening outwardly, by falling back towards the foot of the table. The water spreading over the table, may at pleasure be let into this slit, by raising a bit of leather which is nailed to the table, so as to cover the small door when it is in the shut position; but when this is opened, the piece of leather then hangs down into it. Otherwise the water may be allowed to pass freely above the leather when the door is shut. The same thing may be done with a similar opening placed above the conduit. By means of these two slits, two distinct qualities of *schlich* may be obtained, which are deposited into two distinct conduits or canals. The refuse of the operation is turned into another conduit, and afterwards into ulterior reservoirs, whence it is lifted out to undergo a new washing.

Brunton's machine.—This apparatus appears to be well adapted for the utilisation of the ore contained in very fine slimes At Devon Great Cousols it is extensively employed, not only to concentrate the viscid kind of slime sometimes found at the periphery of the round buddle, but also to dress the tops and middles resulting from the dollying operation.

The small water-wheel, shown in *fig.* 1417, is sufficient to drive six of these

1417



machines, viz. three on each side. Before the stuff is permitted to enter upon the rotating cloth, it is disintegrated by tormentors, and passed through a sizing trommel; it then flows over the head or dispersing board L, on to the cloth. This cloth rotates towards the stream on two axles, H and M, and is supported by a third roller N. It is also stiffened in its width by numerous laths of wood. Clean water is introduced behind the entrance of the slime, in order to give it the proper consistency. Different degrees of inclination are given to the cloth by raising or lowering the roller M, by means of the screw K. The heavier particles lodged on the cloth are caught in the waggon R, whilst the lighter matter is floated over the roller M. The following particulars are furnished by Captain Isaac Richards, of Devon Great Consols :—

One revolution of the cloth is made in 4½ minutes; its length is about 29½ feet, so that it travels say 6½ feet per minute. Its width is four feet two inches.

Before the slime comes upon the cloth it is reduced to a size of $\frac{1}{80}$ of an inch, and yields an average of 1½ of copper; but by means of this machine the stuff is concentrated so as to afford 5 per cent. In ten hours it will clean 1½ tons, at a cost of 1*s.* per ton. The speed of the cloth must, however, be varied with the condition of the stuff; if it be very poor the cloth must travel very much slower, since the enrichment requires a longer period of time.

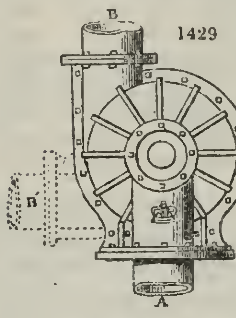
At the end of the machine, and worked by the same water-wheel, is a dolly tub; but the dimensions and mode of working this apparatus are fully stated page 356.

Bradford's slime apparatus, fig. 1418, has been extensively employed at the Bristol Mines, situated in Connecticut, United States.

Its action is intended to imitate that of the vanning shovel. The slime enters by the launder A, about 5 inches wide, and descends on the inclined head A′, which expands from the width of the launder to within a few inches of the width of the table affords very little natural fall. In such case the enrichment of ores becomes more expensive from the necessity of shifting some of the various products by manual labour, and of introducing lifting appliances in order to procure the requisite elevations for carrying out the various elaborative processes. It is, moreover, scarcely practicable from the conformation of the ground to form useful reservoirs of water within a reasonable distance; neither does it commonly occur in such cases that a free supply can be obtained for washing.

The pumping engine is therefore required to furnish the requisite quantity of water. This is generally conveyed over the floors by wood launders, often interfering with each other and obstructing the direct circulation of carts, railways, &c. Now if a stand-pipe or pressure column were erected at the engine, and a main judiciously laid throughout the floors, it is obvious that it would not only remedy this evil, but also afford water for the several washing purposes, as well as motive power for common, dash, or other wheels, together with turbines, flap jacks, &c.

1429



When an inconsiderable proportion of water has only to be raised to a higher level the common shoe or chain-pump will be found to render effective service; but when a larger stream is requisite it would be better to employ the rotary pump. This pump, *fig.* 1429, has been brought to great perfection by Messrs. Gwynne; A is the suction-pipe, and B the discharge, the dotted lines showing the discharge B, horizontal when required.

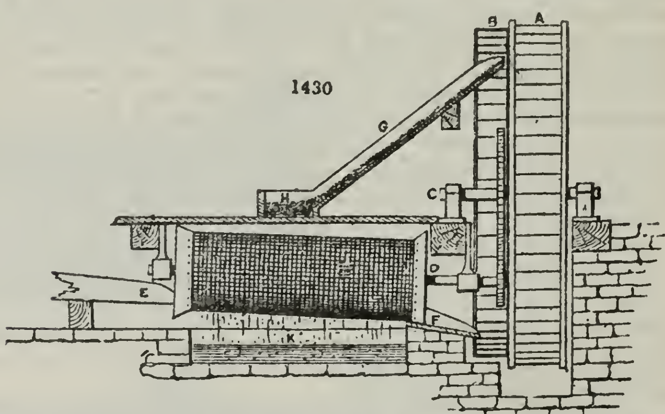
Pumps of the following dimensions are stated to raise and discharge per minute for medium lifts, say from 10 to 70 feet high:—

Diameter of discharge-pipe.	Diameter of suction-pipe.	Gallons of water per minute.
1½ inches.	2 inches.	25
3 "	4 "	70
4 "	5 "	150
5 "	6 "	300
6 "	7 "	500
7 "	8 "	1400

Stuff consisting of slimes and sand may be readily elevated by means of a Jacob's ladder or the Archimedean screw, illustrated at page 437, Vol. I. *fig.* 269. For short elevations combined water and raff wheels devised by Mr. Charles Remfry of Stolberg, Prussia, may be advantageously employed.

Fig. 1430, A, water-wheel; B, raff or inverted wheel; C, axis of both raff and water wheels, carrying a tooth driving wheel; D, sizing trommel; E, launder for inlet of stuff;

1430



F, discharge launder; G, shoot delivering water and raff to launder H; K, cistern receiving slime from trommel.

Slime pits.— In the several operations of cleansing ores from mud, in grinding, and washing, where a stream of water is used, it is impossible to prevent some of the finely attenuated portions floating in the water from being carried off with it

Slime pits or *labyrinths*, called *buddle holes* in Derbyshire, are employed to collect that matter, by receiving the water to settle at a little distance from the place of agitation.

These basins or reservoirs are of various dimensions, and from 24 to 40 inches deep. Here the suspended ore is deposited, and nothing but clear water is allowed to escape.

The workmen employed in the mechanical preparation of the ores are paid, in Cumberland, by the piece, and not by day's wages. A certain quantity of crude ore is delivered to them, and their work is valued by the *bing*, a measure containing 14 cwt. of ore ready for smelting. The price varies according to the richness of the ore. Certain qualities are washed at the rate of 2*s.* 6*d.*, or 3*s.* the bing; while others are worth at least 10*s.* The richness of the ore varies from 2 to 20 bings of galena per *shift* of ore; the shift corresponding to 8 waggon loads.

It is not essential to describe the dressing routine observable in any particular mine, since it is scarcely possible to observe the same system in any two distinct concerns. In the various modes of treatment, however, it may be remarked that the two leading features will always be *reduction* to a proper size and *separation* of the ore from the refuse. Until the vein stuff arrives at the crusher or stamps, the labour is chiefly one of picking and selecting, but from these machines usually commence a long series of divisions, sub-divisions, selections, and rejections. To follow these out in their various ramifications would not only exceed the limits of this paper, but would perhaps be misunderstood by those not intimately acquainted with the subject.—J. D.

OREIDE, a new brass, is the name given by MM. Meurier and Valient, of Paris, to an alloy which has a golden brilliancy.

Copper - - -	100	Sal ammonia - -	3·6
Zinc - - -	17	Quicklime - -	1·80
Magnesia - - -	6	Tartar of commerce	9

The copper is first melted and then the other things are added, by small portions at a time, skimming and keeping in fusion for about half an hour.

The oreide has a fine grain, malleable, takes a most brilliant polish, and has its complexion restored by the use of acidulated water. This brass melts at a comparatively low temperature. The zinc replaced by tin gives an alloy of greater brilliancy.

ORIENTAL AMETHYST. The name given to the violet or lilac-blue variety of sapphire. It forms the passage between that gem and the ruby.

ORIENTAL EMERALD. The name given to green sapphire.

ORIENTAL TOPAZ. The name given to yellow sapphire.

OR-MOLU. A brass in which there is less zinc and more copper than in the ordinary brass; the object being to obtain a nearer imitation of gold than ordinary brass affords. In many of its applications the colour is heightened by means of a gold lacquer. but in some cases, and as we think with very great advantage, the true colour of the alloy is preserved after it has been properly developed by means of dilute sulphuric acid.

ORPIMENT (Eng. and Fr.; *Yellow sulphide of arsenic; Operment; Rauschgelb*, Germ.) is found native in many parts of the world; in Hungary, Turkey, China, &c; the finest specimens being brought from Persia, in brilliant yellow masses, of a lamellar texture, called golden orpiment.

Native orpiment is the *auripigmentum*, or *paint of gold*, of the ancients. It was so called in allusion to its use and its colour, and also because it was supposed to contain gold. From this term, the common name of "*orpiment*," or "*gold paint*," has been derived.

In nature it is found most generally in amorphous masses of a bright yellow colour, but sometimes in crystals, which are oblique rhombic prisms; these crystals are flexible, of a yellow colour. and possess a brilliant lustre.

Native orpiment has a specific gravity of about 3·48. Orpiment is also prepared artificially, chiefly in Saxony, by subliming in cast-iron cucurbits, surmounted by conical cast-iron capitals, a mixture in due proportions of sulphur and arsenious acid. As thus obtained, it is in yellow compact opaque masses, of a glassy aspect; yielding a powder of a pale yellow colour.

Artificial orpiment seems to be a substance of uncertain composition, it containing sometimes, according to Guibourt, 94 per cent. of arsenious acid, and only 6 per cent. of the tersulphide of arsenic. On this account it is much more soluble in water than the native orpiment, and consequently a much more powerful poison. It has been administered several times with criminal intentions, and in many of the cases proved fatal. Orpiment is the colouring matter of the pigment called king's yellow, which is a mixture of arsenious with a little tersulphide of arsenic, just as the sample analysed by Guibourt.

A proper tersulphide of arsenic may be obtained by passing a stream of sulphuretted

[Second Edition.]

N° 10,929 A.D. 1910

Date of Application, 3rd May, 1910

Complete Specification Left, 25th Nov., 1910—Accepted, 16th Feb., 1911

PROVISIONAL SPECIFICATION

Improvements in or relating to Ore Concentration.

We, THEODORE JESSE HOOVER, Metallurgist and Consulting Engineer, and MINERALS SEPARATION LIMITED, both of No. 62, London Wall, in the City of London, do hereby declare the nature of this invention to be as follows:—

This invention relates to improvements in ore concentration. Various processes are known in which one constituent such as the metallic sulphide in an ore is separated from another constituent by gaseous flotation in a liquid. The object of this invention is to provide simple and effective means for the introduction of air or other gas in a state of extremely fine division into an ore pulp in such a way as to effect the gaseous flotation of certain particles. For example, the Patent No. 12,788/1902 describes a process of ore-concentration which consists in mixing the finely powdered ore with water, adding a suitable oil and then liberating a gas in the mixture so as to carry the oiled particles to the surface in the form of a froth, and the present invention is particularly applicable to a process of this general type.

According to this invention the method of introducing air or other gas into an ore pulp for the purpose of effecting flotation of certain particles consists in bringing the ore pulp into contact with a porous medium through which air or other gas is caused to pass. Thus according to one method the pulp is introduced into a vessel having one or more porous walls through which air or other gas can be caused to pass.

The porous media employed according to this invention may consist of plates of porous ceramic material, porous brick, coke, or felt or other fibrous material suitably supported.

The gas which is caused to pass through the porous medium into the ore pulp may be air, or furnace gases or it may be a gas produced chemically such as carbonic acid liberated from a carbonate or the gas may be produced electrolytically, or the gas which is passed through the porous medium may act both as selective agent and as frothing agent; a gas such as formaldehyde or carbon bisulphide vapour can be thus employed. The introduction of the gas through the porous medium may be effected either by pressure or by suction.

This invention is applicable in conjunction with various processes of ore concentration and a number of different means can be employed for carrying the invention into effect. For example, after agitating an ore pulp with an oil in such a way as to agglomerate metalliferous particles into granules according to the British Patents Nos. 26,295/1902, 17,109/1903 and 18,589/1903, the pulp containing the granules and also unoiled particles can in any suitable vessel be brought into contact with a porous medium through which air or gas is caused to pass in minute bubbles or streams whereby the granules are carried to the surface of the pulp.

A number of ways are known for treating an ore pulp to facilitate or to render possible the selective flotation of certain constituent particles in the form of a gaseous froth, see for example the processes described in Patents Nos. 12,778/1902, 7803/1905, 28,173/1908 and 2359/1909. The present invention may be used in conjunction with any such processes, that is to say, the which consists in mixing the finely powdered ore with water, adding a suital oil and then liberating a gas in the mixture so as to carry the oiled partic to the surface in the form of a froth, and the present invention is particular applicable to a process of this general type.

According to this invention the method of introducing air or other gas in an ore pulp for the purpose of effecting flotation of certain particles consis in bringing the ore pulp into contact with a porous medium through wh air or other gas is caused to pass. Thus according to one method the pulp introduced into a vessel having one or more porous walls through which or other gas can be caused to pass.

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In one method of carrying this invention into effect a pulp of the kind described is passed intermittently or continuously into a vessel having one or more porous walls behind which a gas such as air is supplied under pressure so that the gas is forced through the porous diaphragm and in the form of minute bubbles is disseminated throughout the ore pulp. This method of introducing the gas may have three functions. The gas may bring about the necessary agitation of the pulp. The gas being in the state of very fine division is effectively brought into contact with every mineral particle. The fine bubbles of gas readily come to the surface of the pulp in the form of a froth.

Referring to the Patent No. 29,374/1904 the ore pulp is passed over a table on which flotation of the metalliferous particles takes place. According to this invention such a table may have a porous top through which air or other gas under pressure may be introduced into the pulp to effect the flotation of certain particles.

Referring to Patent No. 7803/1905 it is suggested to conduct the agitated pulp to the spitzkasten over a flat trough. According to this invention such a trough may have a porous bottom through which air or other gas is forced, under pressure, so as to create or improve the mineral-bearing froth.

Apparatus for use according to this invention is conveniently continuous in

Page handpressed

crushed ore may be mixed in any convenient way with water with or without acid in solution and with or without an immiscible frothing agent such as oil or soluble frothing agent such as amyl-alcohol, and the pulp may be used at any temperature found suitable

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Referring to Patent No. 7803/1905 it is suggested to conduct the agitated pulp to the spitzkasten over a flat trough. According to this invention such a trough may have a porous bottom through which air or other gas is forced, under pressure, so as to create or improve the mineral-bearing froth.

Apparatus for use according to this invention is conveniently continuous in operation. Thus the ore pulp may be passed through a conduit having walls partly made of porous material and surrounded by a jacket to which compressed air is supplied and the pulp emerging from said conduit may discharge into a spitzkasten.

The supply of compressed air may be produced by induction methods by the flow of the pulp itself.

The porous medium may constitute the wall of a pulp vessel or it may be in the form of tubes, hollow gratings, or boxes in the pulp vessel.

The details of the method and apparatus may be varied without departing from this invention.

Dated this 3rd day of May, 1910.

BOULT, WADE & TENNANT,
111/112, Hatton Garden, London, E.C.,
Chartered Patent Agents.

COMPLETE SPECIFICATION.

Improvements in or relating to Ore Concentration.

We, Theodore Jesse Hoover, Metallurgist and Consulting Engineer, and Minerals Separation Limited, both of No. 62, London Wall, in the City of London, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention relates to improvements in ore concentration. Various processes are known in which one constituent such as the metallic sulphide in an ore is separated from another constituent by gaseous flotation in a liquid. The object of this invention is to provide simple and effective means for the introduction of air or other gas in a state of extremely fine division into an ore pulp in such a way as to effect the gaseous flotation of certain particles. For example, the Patent No. 12,778 of 1902 describes a process of ore concentration

Defendant's Exhibit No. 216

operation. Thus the ore pulp may be passed through a conduit having walls partly made of porous material and surrounded by a jacket to which compressed air is supplied and the pulp emerging from said conduit may discharge into a spitzkasten.

The supply of compressed air may be produced by induction methods by the flow of the pulp itself, by any of the well known methods for obtaining a supply of compressed air by the fall or flow of a liquid.

The porous medium may constitute the wall of a pulp vessel or it may be in the form of tubes, hollow gratings, or boxes in the pulp vessel.

The details of the method and apparatus may be varied without departing from this invention.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is:—

1. The method of introducing air or other gas into an ore pulp for the purpose of effecting flotation of certain particles which consists in bringing the ore pulp into contact with a porous medium through which the air or other gas is caused to pass.

2. The method of introducing air or other gas into an ore pulp for the purpose of effecting flotation of certain particles which consists in introducing the pulp into a vessel having one or more porous walls through which air or other gas can be caused to pass.

3. The method of concentrating ores which consists in mixing the crushed ore with water and with a mineral-frothing agent and introducing air or other gas into the pulp through a porous medium adapted to subdivide the gas into extremely fine streams or bubbles.

4. The method of concentrating ores which consists in agitating the ore pulp with a mineral-frothing agent and passing the pulp over a table having a porous top or over a trough having a porous bottom through which porous parts air or other gas under pressure is introduced into the pulp to effect flotation of certain particles.

5. Apparatus for introducing air or other gas into an ore pulp for the purpose of effecting flotation of certain mineral particles which comprises a porous surface (for example the wall or walls of a containing vessel, the surface of a flotation table or a duct) with which the ore pulp comes into contact at one period of its treatment, and through which air or other gas may be forced or drawn into the pulp.

6. Apparatus substantially as described, for introducing air or other gas into an ore pulp for the purpose of effecting the flotation of certain mineral particles.

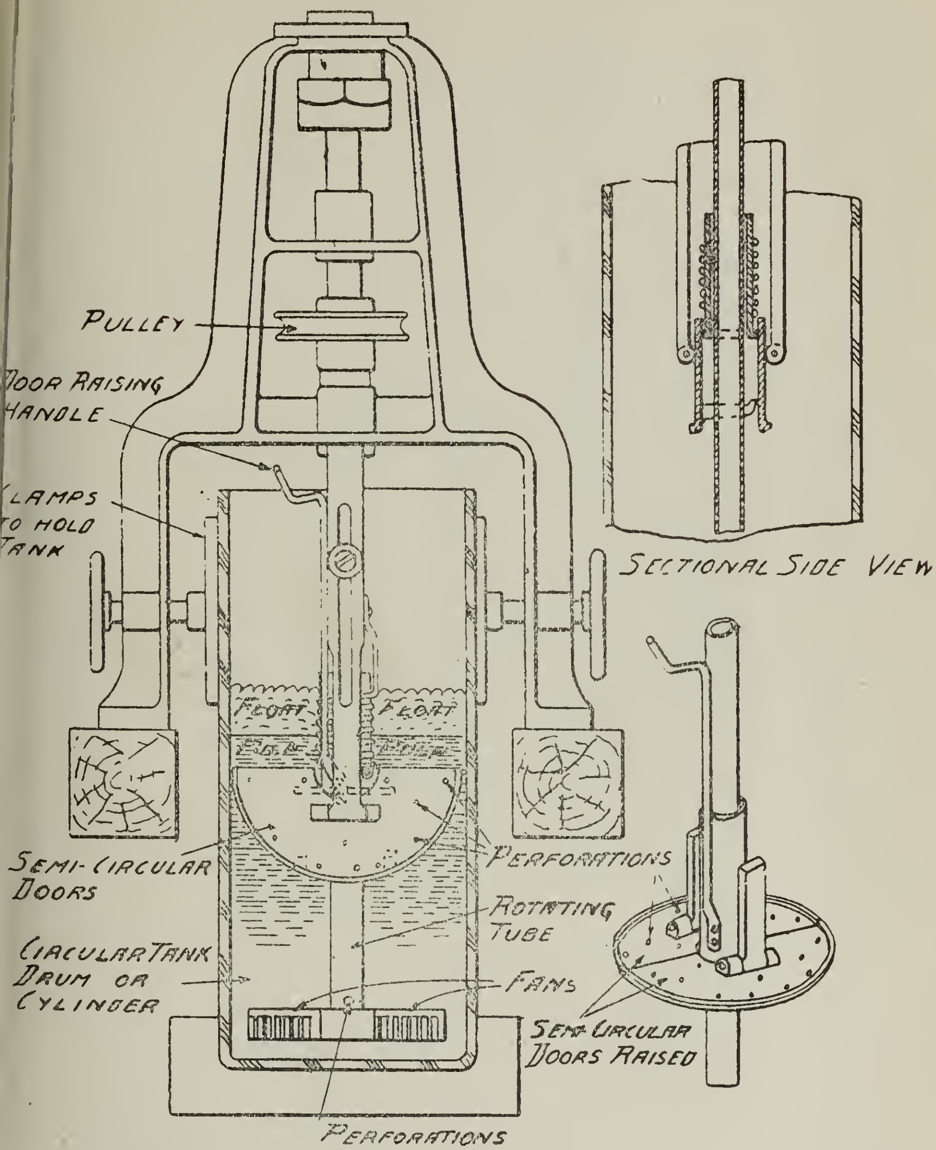
Dated this 23rd day of November, 1910.

BOULT, WADE & TENNANT,
111 & 112, Hatton Garden, London, E.C.,
Chartered Patent Agents.

Redhill: Printed for His Majesty's Stationery Office, by Love & Malcomson, Ltd.
[Wt. 35—50/7/1914.]

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Defendant's Exhibit No. 217.



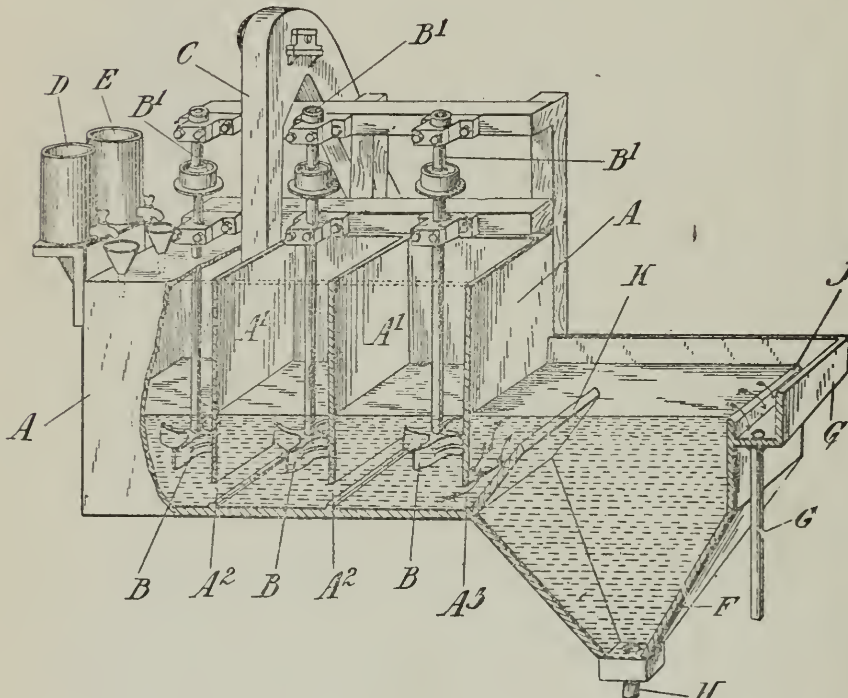
Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

H. L. SULMAN, H. H. GREENWAY & A. H. HIGGINS.

ORE CONCENTRATION.

APPLICATION FILED APR. 30, 1909.

962,678. Patented June 28, 1910



Inventors,
Henry Livingstone Sulman,
Henry Howard Greenway and
Arthur Howard Higgins
By
Knight Bros
attorneys.

Witnesses
J M Wynkoop,
C B Melton

NITED STATES PATENT OFFICE.

LIVINGSTONE SULMAN, HENRY HOWARD GREENWAY, AND ARTHUR HOWARD HIGGINS, OF LONDON, ENGLAND.

ORE CONCENTRATION.

3. Specification of Letters Patent. **Patented June 28, 1910.**

Application filed April 30, 1909. Serial No. 493,207.

iom it may concern:

i known that we, Henry Livingstone , Henry Howard Greenway, and Howard Higgins, subjects of the England, residing at London, Eng- ve invented certain new and useful ments in Ore Concentration of e following is a specification.

invention relates to the concentra- ores, the object being to separate cer- stituents of an ore such as metallic from other constituents such as when the ore is suspended in a liquid water.

rding to this invention the crushed mixed with water containing in solu- small percentage of a mineral-froth- ent, (that is of one or more organic ces which enable metallic sulfids to der conditions hereinafter specified) taining also a small percentage of a acid such as sulfuric acid, and the e is thoroughly agitated; a gas is ed in, generated in, or effectively in- ed into the mixture and the ore par- ome in contact with the gas and the is that metallic sulfid particles float surface in the form of a froth or and can thereafter be separated by ell known means. Among the or- substances which in solution we have suitable for use as mineral-frothing with certain ores are amyl acetate her esters; phenol and its homologues; c, valerianic and lactic acids; ace- and other ketones such as camphor. ne cases a mixture of two such min- othing agents gives a better result single agent. The above mentioned al-frothing agents are all more or less ve in the presence of an acid such as ic acid and are given as types but are tended to form an exhaustive list of le organic substances which may be in this manner and for these objects. e other hand there are many organic ounds which in solution will not effect esult described, such as some sugars, n, saponin, albumen, ox gall, etc., and le test is required in the case of vary- res or materials to determine which ic compound is most suitable.

following is an example of one method rrying this invention into effect:—

Water containing a small percentage of sulfuric acid in solution, say from 2% to 0.5%, and containing in solution a small quantity say 0.1% of one of the foregoing organic substances (say amyl acetate) is, with finely pulverized ore, introduced into an agitating apparatus, in the proportion of say 3 parts by weight of water to 1 part by weight of ore. The agitation is carried out in such a way as thoroughly to disseminate air through the mixture, which is thereafter discharged into a spitzkasten. It is found that a coherent froth or scum floats on the surface of the water in the spitzkasten. This froth contains a large proportion of the metallic sulfids but is substantially free from gangue. Any well known means may be employed for collecting the froth. If desired the tailings can be re-treated by the same process with or without the addition of fresh quantities of the organic materials referred to. The action may in some instances be improved by heating the mixture.

The accompanying drawing is a diagrammatic view in perspective illustrating one form of apparatus partly broken away suitable for use in this process. (The apparatus itself forms no part of this invention.)

Several agitation vessels A are placed in series. These may conveniently be large vats separated by partitions A^1 having openings A^2 at the bottom so that the liquid may pass from one to another. Each vessel is provided with a rotatable stirrer B which is conveniently of the form shown in the drawing. Each stirrer is carried on a spindle B^1 rotated at a high speed by any convenient means. Crushed ore or similar finely divided mineral is fed into the first vessel A through any convenient ore-feeding device such as C, and water is also fed into the vessel A. A small proportion of acid, such as sulfuric acid, may be introduced into the water from the feeding vessel D, and a small proportion of one or more other soluble substances which enable metallic sulfids to be floated by air under the conditions hereafter specified, may be introduced from the feeding vessel E. The liquid containing ore in suspension is vigorously agitated in the agitation-vessels and escapes at the outlet A^3 highly charged with air.

A settling apparatus consisting of one or more spitzkasten F. is placed immediately at the outlet from the agitation apparatus. As shown in the drawing, the spitzkasten F has a launder G to receive the floating froth which passes away through the outlet G'. The liquid and the sunken material pass out through the outlet H at the bottom of the spitzkasten. The level of the liquid in the spitzkasten is slightly above the lip J. Within the spitzkasten is placed an inclined baffle or guide-plate K, which may be made adjustable, extending upward from below the inlet A^3 and arranged to direct the stream of ore-particles and air-bubbles toward the surface of the liquid in the spitzkasten.

Hitherto many proposals have been made for the wet concentration of ores involving the addition to the liquid in which the ore is suspended of an immiscible liquid. For example in the patent granted to Cattermole, Sulman & Picard, United States No. 777274 dated December 13th, 1904, is described a process of ore concentration in which metalliferous particles were coated with a thin film of a fatty or resin acid or a phenol or a cresol by introducing the alkaline compounds of these materials into an acid liquid whereby these materials were liberated in an immiscible or insoluble condition and adhered to the mineral particles. In another known process the powdered ore suspended in water, preferably acidified, is mechanically brought to the surface whereby the particles are exposed to the air and it is found that the metalliferous particles float on the surface while the gangue sinks. In this known process the selective flotation of the metalliferous particles is not due to the metalliferous particles being coated with a selective agent, that is to say, the selective flotation is due to the properties of the metalliferous particles themselves when exposed to air or other gas and brought onto the edge or surface of water preferably acidified.

The present process differs from the two before mentioned types and from other known concentration processes by the introduction into the acidified ore pulp of a small quantity of a mineral-frothing agent *i. e.*, an organic compound in solution of the kind above referred to and by the fact that the metalliferous particles are brought to the surface in the form of a froth or scum not by mechanical means but by the attachment of air or other gas bubbles thereto.

In the frothing processes hitherto known the substances used to secure the formation of a mineral-bearing froth has been oil or an oily liquid immiscible with water. According to this invention the mineral-frothing agent consists of an organic compound contained in solution in the acidified water.

We do not confine ourselves to the proportions above given, the best pr[...] can in each case be easily determined[...]

It is well known that certain o[...] ganic substances we have referred t[...] soluble in water in all proportions [...] if used in excess might partly re[...] soluble in the acidified water and n[...] come mechanically affixed to the m[...] ous particles of the ore. We disc[...] such use of these substances and o[...] them in such amount as will enabl[...] dissolve in the acidified water.

What we claim as our inventio[...] sire to secure by Letters Patent is:

1. The hereindescribed process [...] centrating ores which consists in mi[...] powdered ore with water containin[...] lution a small quantity of a miner[...] ing agent, agitating the mixture t[...] froth and separating the froth.

2. The hereindescribed process of [...] trating ores which consists in mi[...] powdered ore with water containing [...] tion a small quantity of an organic [...] frothing agent, agitating the mi[...] form a froth and separating the fr[...].

3. The hereindescribed process of [...] trating ores which consists in mi[...] powdered ore with slightly acidifie[...] containing in solution a small qua[...] a mineral-frothing agent, agitating [...] ture to form a froth and separat[...] froth.

4. The hereindescribed process of [...] trating ores which consists in mi[...] powdered ore with slightly acidifie[...] containing in solution a small qua[...] an organic mineral-frothing agent, a[...] the mixture to form a froth and se[...] the froth.

5. The hereindescribed process of [...] trating ores which consists in mi[...] powdered ore with water containing [...] tion a small quantity of a mineral-[...] agent, agitating the mixture and bea[...] into it in a finely divided state so as [...] froth and separating the froth.

6. The hereindescribed process of [...] trating ores which consists in mix[...] powdered ore with water containing [...] tion a small quantity of an organic [...] frothing agent, agitating the mixt[...] beating air into it in a finely divid[...] so as to form a froth and separat[...] froth.

7. The hereindescribed process of [...] trating ores which consists in mix[...] powdered ore with slightly acidifie[...] containing in solution a small qua[...] an organic mineral-frothing agent, a[...] the mixture and beating air into [...] finely divided state so as to form a fr[...] separating the froth.

8. The hereindescribed process of [...] trating ores which consists in mix[...]

wdered ore with slightly acidified water containing in solution a small quantity of an organic mineral-frothing agent, heating the mixture, agitating the mixture and beating air into it in a finely divided state so as to form a froth and separating the froth.

9. The hereindescribed process of concentrating ores which consists in mixing the powdered ore with slightly acidified water containing in solution a small quantity of an organic amyl compound, agitating the mixture to form a froth and separating the froth.

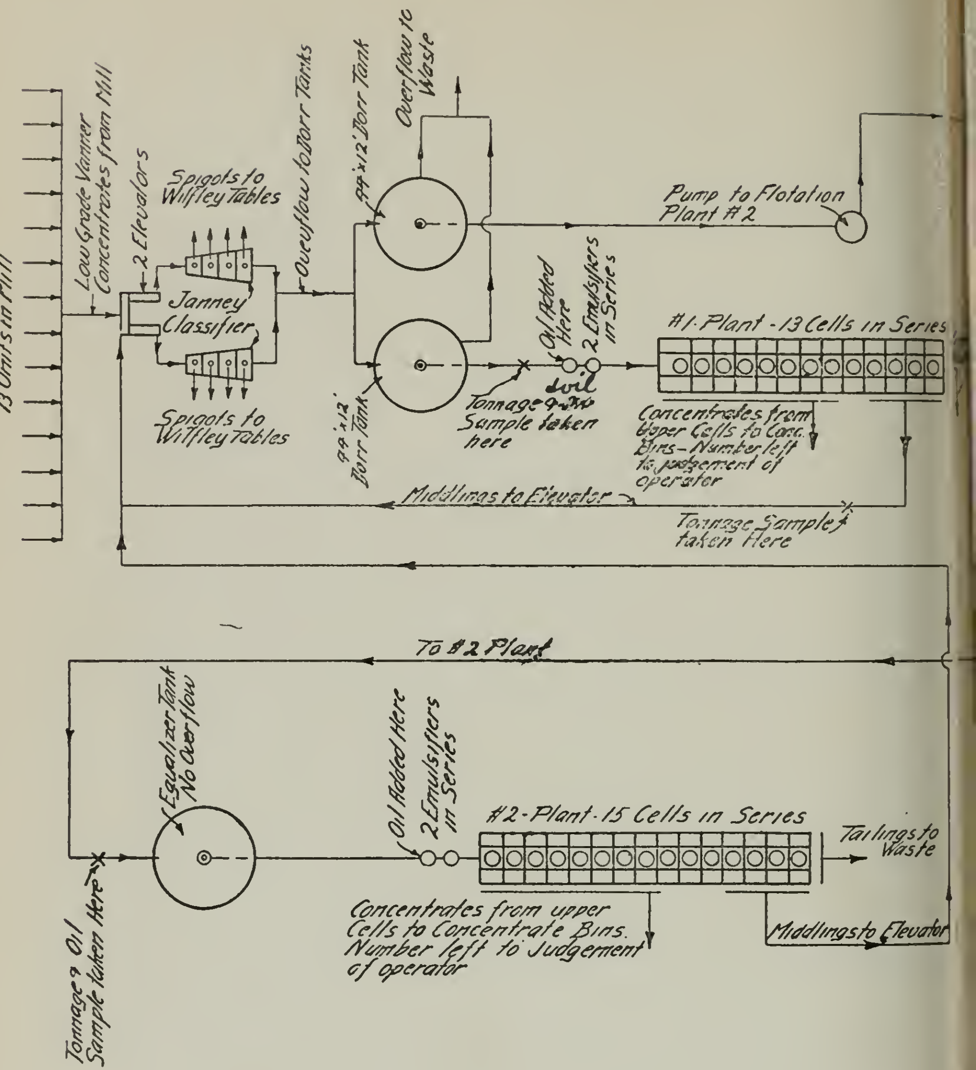
In testimony whereof we have signed our names to this specification in the presence of two subscribing witnesses.

HENRY LIVINGSTONE SULMAN
H. HOWARD GREENWAY.
ARTHUR HOWARD HIGGINS.

Witnesses:
WALTER J. SKERTEN,
E. C. WALKER.

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Defendant's Exhibit No. 219.



FLOW SHEET FOR CONCENTRATE FLOTATION PLANT

ARTHUR PLANT UTAH COPPER CO.

4-21-17

Filed May 18, 1917. GEO. W. SPROULE, Clerk
By H. H. WALKER, Depu

Defendant's Exhibit No. 220.

UTAH COPPER COMPANY—ARTHUR PLANT
METALLURGICAL DEPARTMENT

Eight-hour test made in Retreatment Plant consisting of two Emulsifiers and thirteen Cells using 323.78 pounds of Oil per ton of low grade concentrate.

Test started April 29 at 5.45 P. M. and ended April 30, at 1.45 A. M.

RESULTS.

	Heading	Tailing	Concentrate
Tonnage	91.3	64.1	27.2
Per cent copper (Note a)	5.25	.22	17.10
Per cent iron			16.00
Per cent insoluble			40.00
Pounds oil per ton by assay (Note b)	1.04	20.753	680.175
Pounds new oil per ton	322.74		
Total pounds oil per ton	323.78		
Total pounds oil used	29,560.95		
Total pounds of oil computed from assays	94.95	1330.27	18,500.76
Ratio of concentration	3.356 into 1		
Per cent indicated copper extraction	97.058		
Per cent solids in feed	18.03		
Pounds alkaline reagent per ton	6.37		

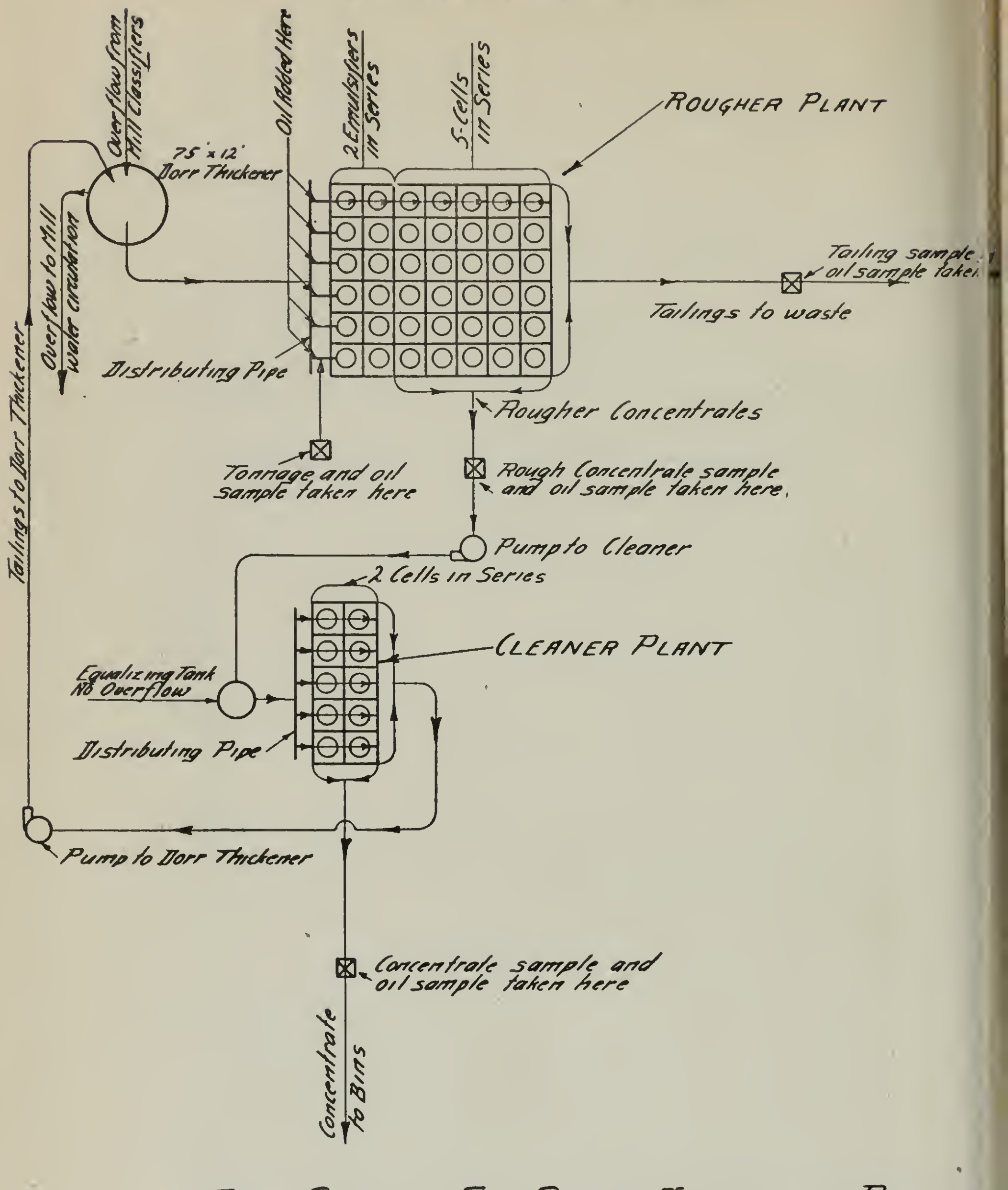
Kind of oil used—a mixture composed of 59% Fuel Oil, 30% Jones Oil, 10% American Creosote No. 2, and 1% Yaryan Pine Oil.

(a) On account of the products containing so much oil they were washed with an oil solvent before the metal assays were made.

(b) These figures represent the amount of oil per ton of original material treated and the resultant products.

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Defendant's Exhibit No. 221.



FLOW SHEET FOR SLIME FLOTATION PLANT

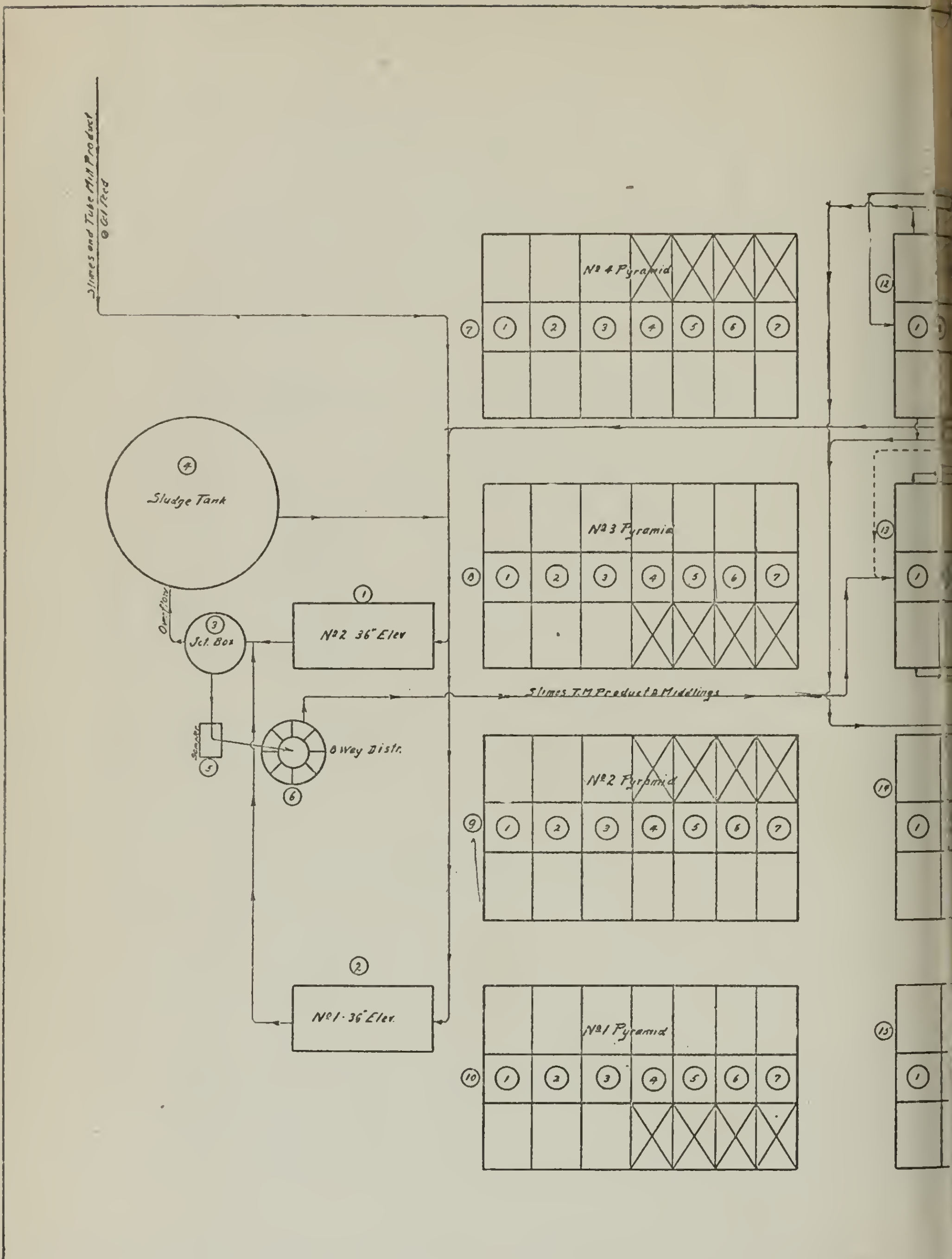
ARTHUR PLANT UTAH COPPER CO.

4-21-17

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

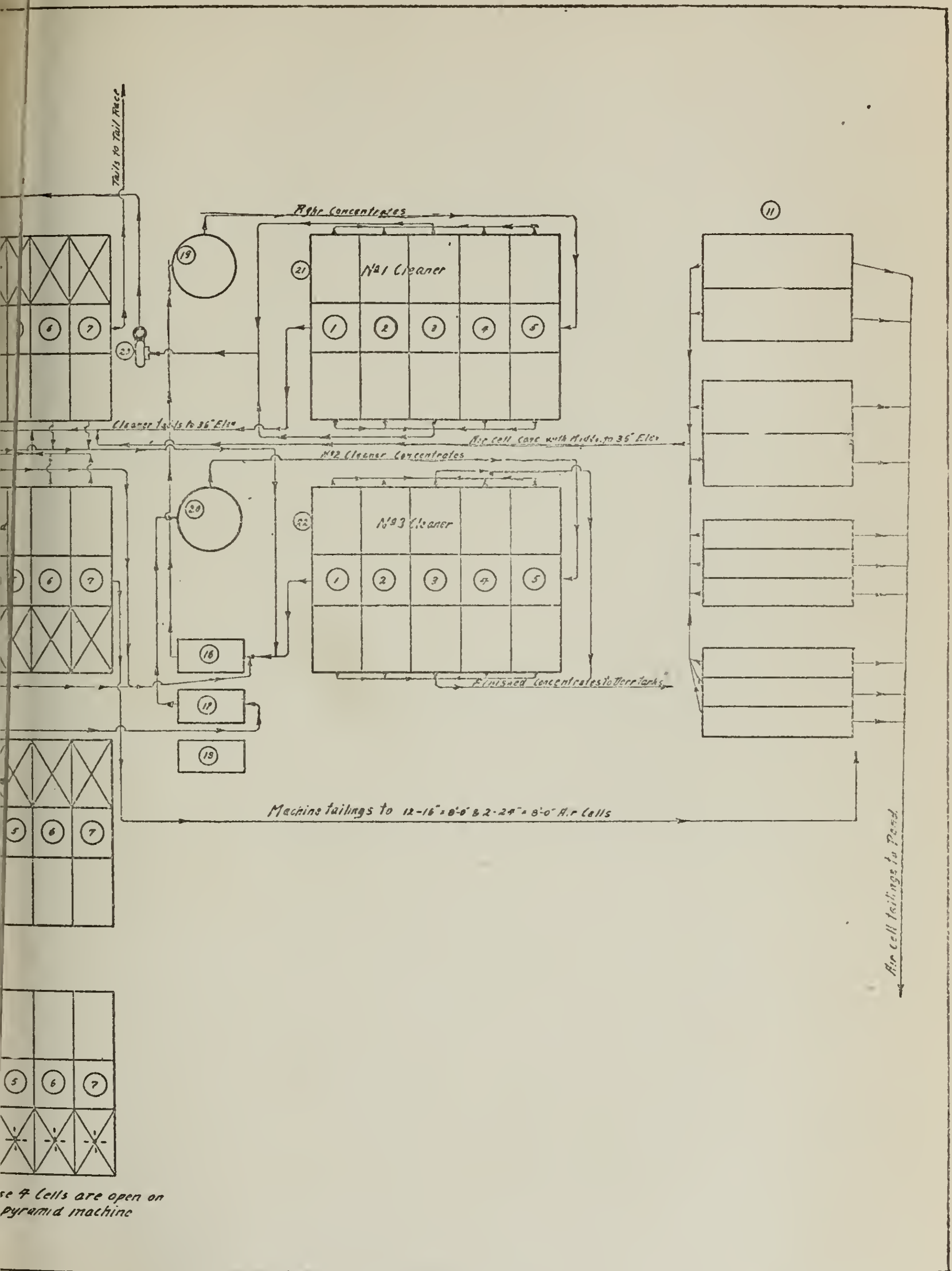
Defenda

FLOW SHEET BUTTE



it [o. 222.

ORFLOTATION PLANT



Filed August 15, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Defen

BUTTE &

FLOTATION PLANT OPER

DATE	H^2SO^4	REAGENTS USED Lbs. per Ton of Flotation Feed $CuSO^4$	Metallic Copper	Initial Oil	Lbs. per Ton Oil in Concts. & Tails	PER CENT OI Heads & Middling Return	Concts.
Feb. 1....	8.07	5.17	.062	10.77	11.00	.64	1.45
Feb. 2....	7.17	5.99	.072	13.94	11.40	.70	1.34
Feb. 3....	9.20	6.96	.098	17.78	13.80	.73	1.36
Feb. 4....	8.37	5.23	.063	19.83	11.00	.74	1.12
Feb. 5....	8.61	5.92	.071	20.99	12.20	.79	1.12
Feb. 6....	12.69	5.64	.068	24.31	15.20	.78	1.04
Feb. 7....	7.83	5.65	.068	19.03	13.40	.76	1.34
Feb. 8....	10.73	5.40	.065	16.86	13.00	.79	1.10
Feb. 9....	9.45	5.81	.070	19.65	13.00	.75	1.53
Feb. 10....	11.36	8.20	.098	20.75	18.20	1.08	2.10
Feb. 11....	7.69	5.11	.061	15.34	12.00	.85	1.59
Feb. 12....	10.81	6.70	.080	16.24	18.40	1.14	2.31
Feb. 13....	11.60	6.63	.079	19.62	20.80	1.36	2.66
Feb. 14....	18.40	7.02	0.84	13.93	17.20	1.12	2.49
Feb. 15....	7.31	6.27	.075	16.57	16.00	.99	2.24
Feb. 16....	11.57	8.53	.124	24.86	16.40	1.27	1.94
Feb. 17....	10.43	8.92	.130	22.05	19.60	1.24	1.95
Feb. 18....	10.49	8.00	.116	21.80	18.80	1.74	1.94
Feb. 19....	10.65	11.00	.153	21.40	19.40	2.02	2.02
Feb. 20....	9.62	10.45	.153	21.56	18.80	2.51	1.93
Feb. 21....	7.84	5.37	.074	17.69	18.80	1.24	1.87
Feb. 22....	10.92	7.64	.100	20.22	18.80	2.85	2.29
Feb. 23....	11.71	4.31	.064	14.97	21.20	1.35	2.47
Feb. 24....	11.76	7.59	.097	24.13	17.40	1.05	2.08
Feb. 25....	9.77	7.59	.097	22.41	15.80	1.13	1.66
Feb. 26....	9.60	5.73	.079	24.17	16.20	1.17	1.69
Feb. 27....	10.47	8.00	.109	20.85	19.40	1.14	1.61
Feb. 28....	7.74	6.84	.094	19.30	20.60	1.26	1.90

Butte, Montana,
April 21, 1917.

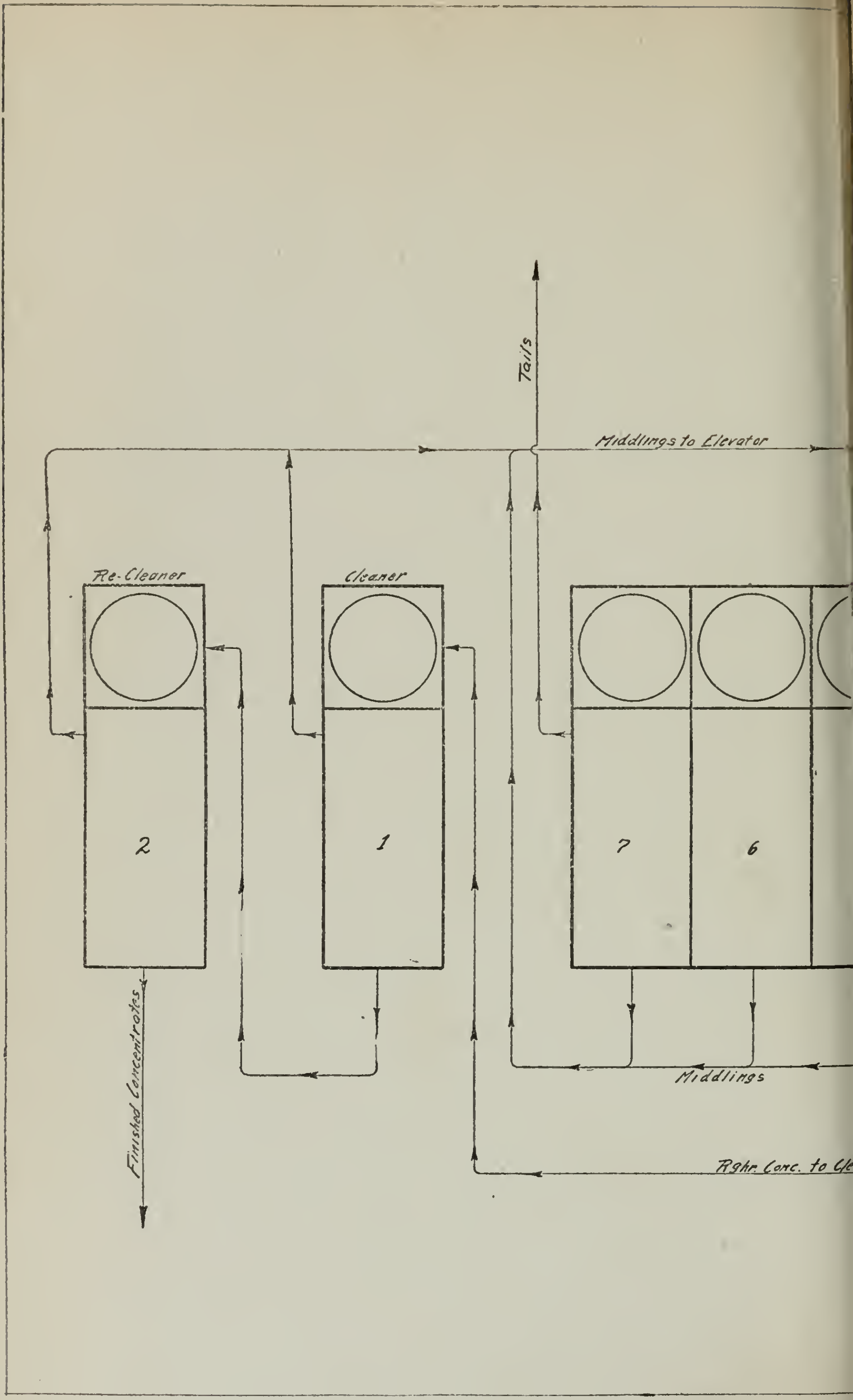
Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

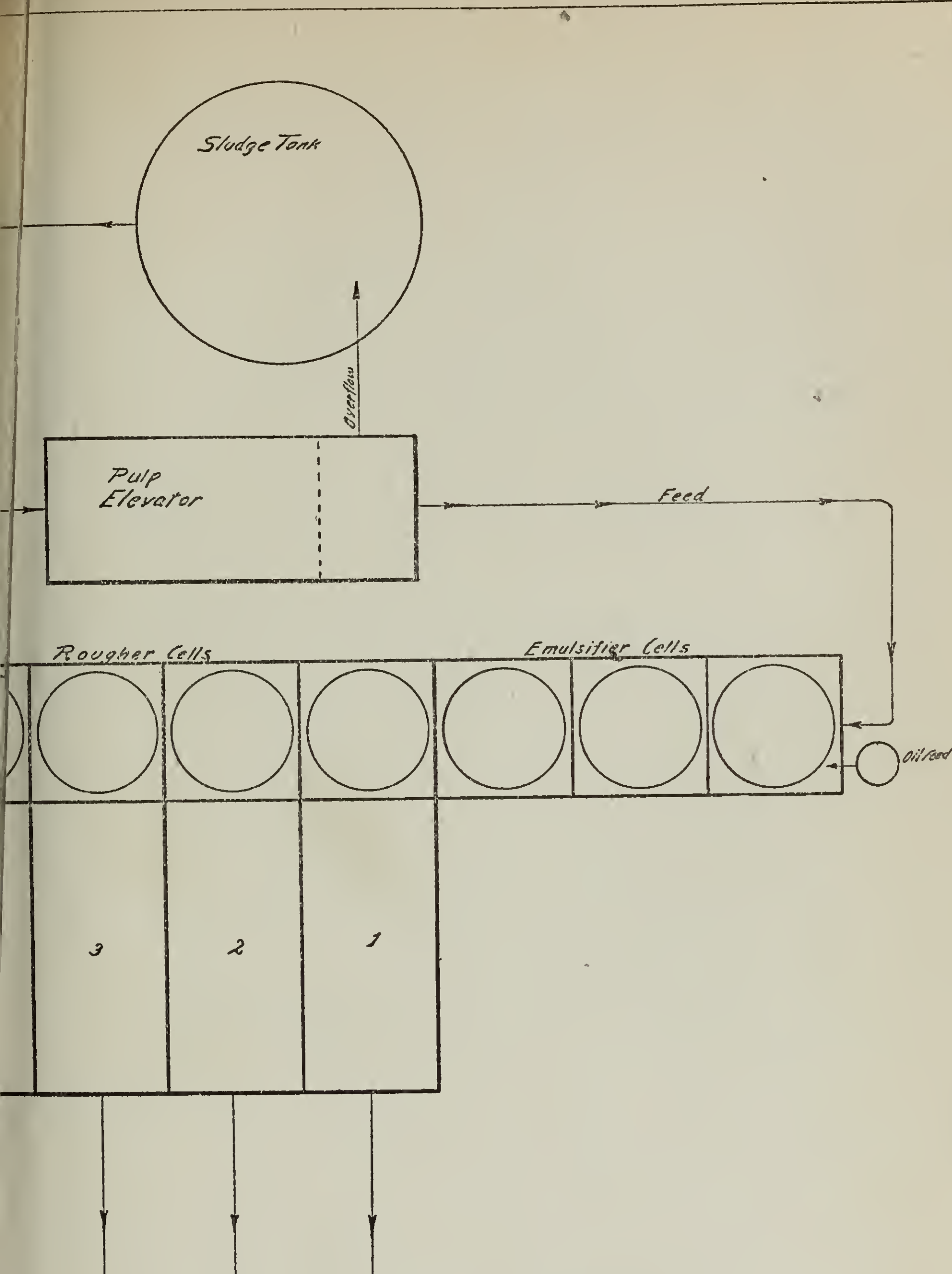
No. 223.

G COMPANY

MONTH OF FEBRUARY, 1917.

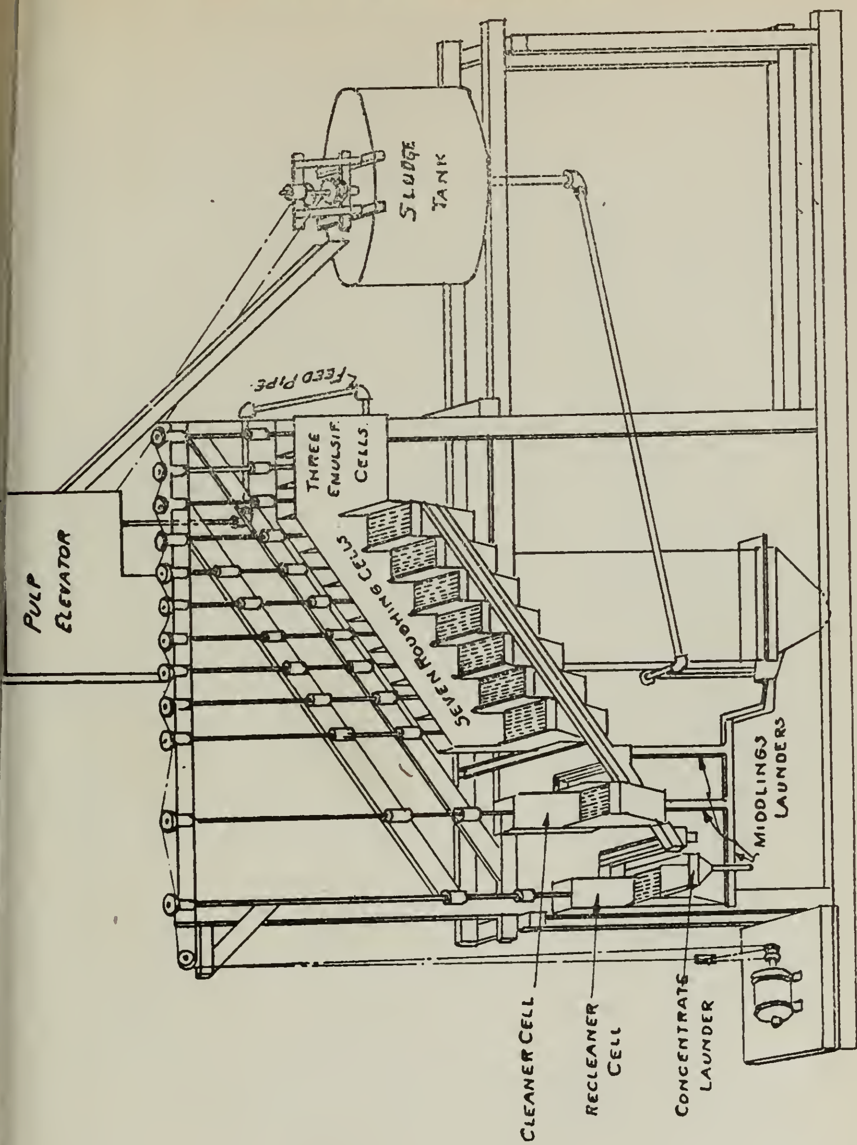
ZINC		Dilution of Feed	Temperature of Feed Deg. C.	REMARKS
	Tailings			
0	1.41	2.2 to 1	29	Good run
0	1.13	3.3 to 1	29	Good run
0	2.42	3.3 to 1	26	High tailings due to poor operation on No. 1 Rougher
0	2.12	2.4 to 1	20	Machines handling too coarse feed
0	2.04	2.7 to 1	34	Feed still too coarse for good results
0	2.12	2.6 to 1	24	Several changes in reagents caused a rather erratic and unsettled condition throughout the plant
0	2.06	2.9 to 1	19	Elevators going in pit off and on all day
0	3.40	2.6 to 1	19	Elevators still giving considerable trouble
0	2.76	2.6 to 1	21	Considerable trouble with frozen oil lines, causing many changes in reagents, hence poor operative results
40	2.24	2.4 to 1	27	Conditions on this day same as that of previous day
20	1.81	2.9 to 1	24	Mill down first two shifts account lack of ore
20	2.60	2.7 to 1	25	Elevators in Pit most of day. All feeds cut off for 2½ hours on this account
70	3.80	2.1 to 1	24	Conditions in plant unsettled due to overfeeding machines and more or less elevator trouble
70	1.96	2.4 to 1	28	Good run
70	2.90	1.8 to 1	28	Rougher Concts. direct to bins, account mechanical difficulties on cleaners and recleaners
.80	1.49	1.9 to 1	21	Fair run
.40	1.67	2.8 to 1	18	Fair run
.40	1.10	1.4 to 1	21	Fair run
.80	.92	2.2 to 1	21	Fair run
.50	.90	2.6 to 1	23	Fair run
.00	.99	2.0 to 1	24	Very good run considering the fact that the machines were handling an extra large tonnage
.30	2.19	2.2 to 1	21	Elevators giving considerable trouble Middling return cut down to lighten load to elevators
1.70	2.24	2.3 to 1	18	Changed reagents several times during day which caused confusion in entire plant
3.60	2.10	2.4 to 1	20	Same trouble as day previous
3.60	1.01	2.8 to 1	16	Cleaner and recleaner cells out of order
3.20	1.19	2.5 to 1	16	Cleaner and recleaner still out of order and elevators giving considerable trouble
1.30	1.69	2.7 to 1	16	Trouble at concentrate bins caused considerable trouble in plant account shutting down and starting again
3.90	2.50	2.2 to 1	14	Overfeeding machines and elevators. Unable to handle return feed


Tails
Middlings to Elevator
Re-Cleaner
Cleaner
2
1
7
6
Middlings
Finished Concentrates



Filed August 23, 1917. GEO. W. SPROULE, Clerk. By H. H. WALKER, Deputy.

Defendant's Exhibit No. 225.



Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Defendant's Exhibit No. 226.

Butte & Superior seven-cell test machine—
Physical Exhibit

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Defendant's Exhibit No. 227.

Butte, Montana,
May 5th, 1917.

Mr. J. L. Bruce,
Manager,
Plant.

Dear Sir:—

Attached hereto tabulated sheets showing results of samples taken from 1:00 to 5:00 P. M., Sunday, April 29th at which time representatives of the Mineral Separation Company and representatives of the Butte & Superior Mining Company were present during the time all samples were taken, placed in containers, and marked, also copy of letter from Edward Walser, Chief Chemist, R. B. Stringfield, Oil Chemist and T. R. Featherly, Head Sampler, describing the manner in which all samples were handled. I was present during the entire period when the samples were taken.

Flotation Head, Flotation Concentrate and General Mill tailings samples were taken from the automatic samplers, cutting every 7½ minutes. Alternating cuts were turned over to representatives of the Minerals Separation Company and page No. 3 is analyses of the the other alternating cuts retained by our representatives. Hand samples were taken of the first, second and third Spitz on the North side of the No. 5 Pyramid machine and the South side of the No. 6 Pyramid machine, which I consider fairly represents the Rougher concentrates. Samples were taken from the Nos. 4, 5, 6, and 7 Spitz of the same machines, which

Defendant's Exhibit No. 227

would fairly represent the middlings returned from the Roughing machines. These samples do not include the first and second cleaner tailings, which were also returned to the head of the machines as middlings. Grab samples were taken of the crude ore from the mine bin, the Mill Heads at the Tripper, the discharge product from Tube Mills Nos. 2 and 3, Section 2, and Spigot products from the 40′ and 50′ Settling tanks. The last two samples cannot be considered representative of regular operations as they were only grab samples. Sample of the Nos. 1, 2 and 3 cleaner tailings were also grab samples and cannot be considered representative of regular operations.

Yours very truly,

J. T. Shimmin,
Mill Superintendent.

JTS:JDS

Defendant's Exhibit No. 227

Sheet No. 1

BUTTE & SUPERIOR MINING COMPANY

Special Report of Flotation Operation 1:00 to 5:00 P. M., 4/29/17

OILS—

NAME	% of Total	Pounds per Min.	Lbs. for Four Hours	Specific † Gravity
Standard Yaryan Pine	24.30	7.035	1689	.9050
Fuel Oil	64.47	18.664	4479	.5860
Commercial Kerosene	11.23	3.251	780	.8195
Mixture	100.00	28.950	6948	.8821

OTHER REAGENTS—

NAME	cc's per Min.	Lbs. for Four Hours	Specific Gravity
Sulphuric Acid to Distributor	1497.8	1865	1.705
" " " Slimes	571.0		
Copper Sulphate to Distributor	2452.8	1712	1.321

Period of Operation..........Four hours
Flotation feed tonnage for four hours..........263.53 dry tons
Flotation concentrates produced..........60.16 dry tons
Temperature of feed..........Atmospheric
Dilution of feed..........3.45 : : 1

OILS AND REAGENTS USED

Pine Oil lb./Ton	Fuel Oil lb./Ton	Commercial Kerosene lb./Ton	Sulphuric Acid lb./Ton	Copper Sulphate A.C.M. Solution lb./Ton
6.41	17.00	2.96	7.08	(a) 6.50

(a) Equivalent to 0.10 pounds metallic copper per ton
Metallic copper consumed..........26.022 pounds
Actual initial oil added per ton..........26.37 "

The assay results and oil analyses for this period are as follows,

FLOTATION FEED INCLUDING

	CIRCULATING LEAD		TAILING		CONCENTRATE	
	Assay % Zn.	Analysis % Oil	Assay % Zn.	Analysis % Oil	Assay % Zn.	Analysis % Oil
1-5 P. M.	12.6	1.77	1.57	0.67	45.2	3.13

Apparent Recovery—89.58% (Figured from theoretical flotation feed)

NOTE, † Specific Gravity of oil reagents was determined on the samples taken during this test.

Defendant's Exhibit No. 227

Sheet No. 2

BUTTE & SUPERIOR MINING COMPANY

Notes to Accompany Sheet No. 1

% OF TOTAL OIL—

Inventory for 4/29/17 showed:

Lbs. Standard Yaryan Pine used................ 8,844=24.30% of total
" Fuel Oil used..23,467=64.47% of total
" Commercial Kerosene .... 4,086=11.23% of total

Total oil used..................................36,397

TONNAGES

Mill Heads (24 hours=1602 dry tons)
5 feeders on medium=48 R. P. Hour.................................Factor .2926
5x48x4x.2926= ....280.9 dry tons

Mill Lead Concentrates (24 hrs.=7 dry tons)

$$\frac{\text{Mill Heads for 4 hours}}{\text{Mill Heads for 24 hours}}=\frac{281}{1602}=0.1754$$

7x.1754= ....1.23 dry tons

Mill Zinc Concentrates (24 hrs.=92 dry tons)
92x.1754= ....16.14 dry tons

Flotation Concentrates (24 hrs.=343 dry tons)
343x.1754= ....60.16 dry tons

Flotation Feed
Mill Heads—(Mill Lead plus Zinc)=
280.9 — 17.37= ....263.53 dry tons

ASSAYS

Mill Lead Concentrates (11.95% Zn.)
1st shift = 11.0% Zinc..Mill Heads = 491 tons
2nd shift = 12.8% " .... " " = 554 "

$$\frac{491\text{x}11.0 \text{ plus } 554\text{x}12.8}{1045} = 11.95$$

Mill Zinc Concentrates (46.35% Zn.)
1st shift = 45.5% Zinc
2nd " = 47.1% "

$$\frac{45.5\text{x}491 \text{ plus } 47.1\text{x}554}{1045} = 46.35$$

Theoretical Flotation Feed (11.60 Zn.)

Mill Head tonnage x Zn. assay—(Mill Pb. tonnage x Zn. Assay plus Mill Zn. tonnage x Zn. Assay)

Flotation Feed Tonnage

$$\frac{280.9\text{x}13.6\text{—}(1.23\text{x}11.95 \text{ plus } 16.14\text{x}46.35)}{263.53} = 11.60$$

Apparent Recovery (89.58%)
C=Flotation concentrate assay = 45.2 % Zn.
H=Flotation Feed assay (theoretical) = 11.60% Zn.
T=Mill Tailings assay = 1.57% Zn.

$$\frac{C\ (H-T)}{H\ (C-T)} = \frac{45.2\ (11.6-1.57)}{11.6\ (45.2-1.57)} = .8958$$

Defendant's Exhibit No. 227

Sheet No. 3

BUTTE & SUPERIOR MINING COMPANY

Special Samples—Flotation Operation—1:00 to 5:00 P. M. April 29th, 1917

SAMPLE, ANALYSES, OIL AND DILUTIONS

NAME	ANALYSIS % Cu.	% Pb.	% Zn.	% Insol.	% Fe.	% Mn.	% Oil	Dilution	Taken By
Flot. Feed No. 1 Bucket			11.15				1.57	4.0	
" " No. 2 "			12.1				1.17	3.5	
" " No. 3 "			12.3				1.60	3.7	
" " No. 4 "			13.5				1.80	2.5	J.W.L.
" " No. 5 "			13.5				2.03	3.6	C.K.B.
" " No. 6 "			13.2				1.72	3.6	
" " Composite	0.14	0.77	12.6	63.6	1.85	1.31	1.77	3.45	
Flot. Conc.—Finished Pro.	0.57	3.35	45.2	19.0	2.78	0.40	3.13	3.0	C.F.W.
General Mill Tails No. 1 Bucket			1.40				.50	3.0	J.W.D.
" " " No. 2 "			1.71				.62	3.3	W.A.B.W.
" " " No. 3 "			1.76				.71	3.5	C.C.R.
" " " Composite	0.053	0.10	1.57	90.0	0.70	1.47	.67	3.26	H.J.S.
Rougher Conc. 1st Spitz	0.53	3.55	35.2	32.0	2.89	0.76	2.77	4.1	
" " 2nd "	0.55	2.70	35.4	33.2	2.89	0.70	2.56	3.6	
" " 3rd "	0.50	2.45	37.7	29.2	3.44	0.70	2.85	3.4	Wilding
Primary Midds—4-7 Spitz	0.17	0.45	10.8	73.6	2.02	1.31	1.68	6.0	J.W.S.
" Tails	0.026	0.10	1.16	91.8	0.55	1.53	.35	2.3	
1st Cleaner Tails			16.70				2.18	6.4	
2nd " "			8.65				2.24	8.2	G.A.C.
3rd " "			12.35				2.74	10.4	A.W.H.
Slime Feed to Sludge Tank	0.14	0.88	13.6	70.4	1.36	1.36		2.4	
No. 4 Sec. 1 No. 1 Sec. 2—T. M. Dischg.	0.12	0.45	8.9	80.6	1.36	1.20		0.7	
Crude Ore taken from Bins	0.43	0.60	22.3	59.2	2.29	0.35		—	J.L.G.
Crude Ore taken from Tripper	0.23	1.13	16.1	67.0	2.18	0.94		—	T.F.

Defendant's Exhibit No. 227

BUTTE & SUPERIOR MINING COMPANY

Special Samples—Flotation Operation—1:00 to 5:00 P. M., 4/29/17
Samples Taken 4/29/17—1:00 to 5:00 P. M.

Name of Sample	SAMPLERS M. S. Co.	B. & S. Co	Remarks
General Mill Tailings	Walling	Riser Stiebel	3 buckets each party automatic sampler—7½ min.
Flotation Head Sample	Littleford	Bain	6 buckets each party automatic sampler—7½ min.
Flotation Concentrates	C. F. Williams	Dudgeon Hunter	1 bucket each party automatic sampler—7½ min.
No. 1 Spitz Rghr. Conc. S. Side No. 6 No. 2 " " " N. Side No. 5 No. 3 " " " No. 4-7 " Midds. Tails No. 5 Pyramid only	Wilding Pudan	Sheedy Burns	Hand samples every 30 minutes
SPECIAL SAMPLES			
1st Cleaner Tails 3:10 P.M. 2nd " " 3:15 P.M. 3rd " " 3:20 P.M.	Chapman	Hackwood	Grab sample—1 acid bottle " " —1 " " " " —1 " "
No. 4 Tube Mill Sec. 1, No. 1 Tube Mill Sec. 2—Discharge Slime Feed to Sludge Tank Crude Ore Sample from Tripper Crude Ore sample from Bins	Greniger	Featherly	Grab sample—1 acid bottle " " —1 " " " " —Approx. 12 lbs. " " — " " "
Cu SO4 & H2SO4 to Dist.	Martin	Engleman	Measured every 15 minutes 125 c.c. taken for sample each time
Oils	Williams	Conrad Cornelius	Measured every 15 minutes 250 c.c. taken for sample each time
Individual Oils H2 SO4 to Slimes	Schultz Wilkinson	Hollister Lewis	Sampled from 3:00 P.M. to 5:00 P.M.

Defendant's Exhibit No. 227

Sheet No. 5

BUTTE & SUPERIOR MINING COMPANY

Special Samples—Flotation Operation 1:00 to 5:00 P. M., 4/29/17

General Method of Treating Samples After Arriving at the Sampling Department

FOR OIL:—Samples consisting of more than one bucket:
- 1 cup from each bucket for separate oil analysis
- 1 cup from each bucket for composite oil analysis

Samples consisting of one bucket, one cup was taken for oil analysis

Samples which had been put in an acid bottle were transferred to a bucket and one cup taken for oil analysis

DILUTION:—All samples excepting the crude ore from the tripper and the mill bins were weighed before and after drying

FOR ASSAY:—Samples consisting of more than one bucket:
- Dried contents of each bucket cut in halves
- One set of halves were combined for a composite sample
- Other set of halves assayed separately

Samples consisting of one bucket:
- Assay sample cut out

REJECTS:—All rejects saved and sacked

JDS

....

Mill Superintendent.

Defendant's Exhibit No. 227.

May 1st, 1917.

Mr. J. T. Shimmin,
Mill Superintendent,
Plant.

Dear Sir:—

On April 29th, 1917, representatives of the Mineral Separation Company Ltd., visited the Butte & Superior Mining Company's mill to take samples of various products in the flotation plant, and mill in general if so desired, and also to inspect the plant in general.

One or more of these visitors were escorted through the plant by a representative of the Butte & Superior Mining Company.

Samples were taken for a period of four hours, between the hours of 1:00 and 5:00 P. M. The flotation feed, concentrates and general mill tailings were taken by the automatic sampler, which cuts a sample every seven and one-half minutes. The primary tailings, middlings and rougher concentrates were taken by hand, every fifteen minutes.

Oil samples were taken of the plant mixture that was being used during the period of sampling to ascertain the amount of oil being used. A measurement was taken every fifteen minutes, which was weighed out. Copper sulphate solution and sulphuric acid was sampled every fifteen minutes but was measured in cc's per minute.

Special samples were taken on the first, second and third cleaner tailings. But one sample was taken of these products and placed in acid bottles.

Defendant's Exhibit No. 227.

Special samples were also taken of the slime feed to the sludge tank, discharge of No. 4 tube mill section 1, and No. 1 tube mill section 2.

A sample of mill feed was taken at the mill bins, on the tripper, and which was also taken by hand, and placed in a bottle. A sample of rock was taken from the mine bin, which was listed as a grab sample.

A representative of both companies was present at all times where samples were being taken. All samples were taken in duplicate, alternating cuts for each side so that both samples would be fair and representative.

At the close of the set time for sampling, all samples were turned into the sampling department, where the following method was used in drying and cutting down.

In every case where more than one bucket composed a sample each bucket was weighed and dried and a sample cut out for assay. Before being weighed an oil sample was taken. Each bucket sample was cut in half so a composite could be made up and an assay of the composite obtained.

Screen analyses were run on rejects of samples and on the composite samples of the flotation feed and general tailings. Screens will be run for weight of material and zinc.

All results of assays, weights, dilutions, oil and screen analyses will be reported under separate cover.

Yours truly,

T. R. Featherly.

TRF:JDS

Defendant's Exhibit No. 227.

May 2nd, 1917.

Mr. J. T. Shimmin,
Mill Superintendent,
Plant.

Dear Sir:—

The following is the analytical procedure used in determining the percentages of oil in the various products from the test run made in co-operation with Minerals Separation representatives, Sunday April 29th, 1917, from 1:00 to 5:00 P. M. This procedure has been thoroughly tested in this laboratory and proven accurate for the oil mixtures used and conditions prevailing in this plant.

ANALYTICAL PROCEDURE

The wet sludge, as received from the sampling department, was thoroughly mixed and immediately thrown on wet filter paper contained in a Buchner funnel. Suction was then applied and the water thoroughly drained; the resulting production containing from 10 to 15% moisture.

This product was removed from the filter paper as completely as possible, well mixed with a spatula, and duplicate samples, approximately two grams of dry substance each, placed in small porcelain crucibles, which were placed in a dessicator over dry calcium chloride. The dessicator was then sealed and allowed to remain at a temperature of about 20° Centigrade for fifteen hours, without opening. This has been proven to be sufficient time to completely dry the samples; the residue being dry ore and oil.

Defendant's Exhibit No. 227.

These dry residues were transferred to tared alundum extraction thimbles, which were then accurately weighed, placed in Sohlet extractors, and extracted with ether for one hour and fifteen minutes, thus removing all the oil present in the sample. The thimbles plus the oil-free ore were then removed, dried at about 40° Centigrade, cooled, and weighed; the loss in weight being considered as oil, and being calculated to percent in dry oil-free ore.

For example:—

Weight thimble plus ore plus oil (before extraction)	12.2970	gms.
Weight thimble plus ore (after extraction)	12.2720	
	.0250	gms.
Weight thimble plus ore (after extraction)		
Weight thimble empty	10.216	
Weight dry ore	2.056	gms.

$$\frac{\text{Weight Oil}}{\text{Weight dry ore}} = \frac{.0250}{2.056} = 1.22\%\ \text{oil}$$

Very truly yours,

R. B. Stingfield.

RBS/EGB

Copy to:—D. C. Jackling.
H. B. McKelvie.
J. L. Bruce.
W. A. Scott.
J. B. Kremer.
J. T. Shimmin.
B. H. Dosenbach.
Chas. Bocking.

P. 5300, erase lines 16 and 17 and substitute :

" Weight oil	.0250 gms.
Weight thimble plus ore (after extraction)	12.272 gms.

Defendant's Exhibit No. 227.

May 4th, 1917.

Mr. J. T. Shimmin,
Mill Superintendent,
Plant.

Dear Sir:—

Our regular methods have been employed in determining the various metals and other constituents in the samples taken during the test run made in conjunction with Minerals Separation experts on Sunday April 29th 1917, from 1:00 to 5:00 P. M.

Yours very truly,

Edw. Walser,
Chief Chemist.

EW/EGB

CC to:—D. C. Jackling.
N. B. MacKelvie.
J. L. Bruce.
C. Bocking.
W. A. Scott.
J. B. Kremer.
J. T. Shimmin.
B. H. Dosenbach.
Edw. Walser.

Filed May 18, 1917.

GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Defendant's Exhibit No. 228.

BUTTE & SUPERIOR MINING COMPANY

Data Compiled From Original Records of Flotation Plant Operations
Month of November, 1916.

FLOTATION PLANT FEED

Date November	Lbs. H_2SO_4 66 Deg. B. Per Ton	Lbs. Cu. Per Ton
1	6.49	.12
2	5.84	.11
3	5.73	.11
4	5.84	.11
5	6.04	.11
6	5.94	.11
7	7.10	.13
8	7.28	.13
9	6.14	.11
10	5.88	.11
11	6.83	.12
12	8.66	.15
13	7.62	.13
14	6.55	.11
15	6.94	.12
16	6.42	.11
17	6.24	.11
18	6.41	.11
19	10.84	.20
20	6.02	.11
21	4.45	.11
22	4.84	.13
23	4.32	.11
24	4.27	.11
25	4.19	.11
26	5.04	.13
27	3.90	.10
28	4.07	.11
29	5.86	.12
30	4.86	.11

Compiled May 2, 1917.

J. T. SHIMMIN,
Mill Superintendent.

Filed May 18, 1917. GEO. W. SPROULE. Clerk.
By H. H. WALKER, Deputy.

Defendant's Exhibit No. 229.

In The
SUPREME COURT OF THE UNITED STATES

October Term, 1916

No. 46

MINERALS SEPARATION, LIMITED and MINERALS SEPARATION AMERICAN SYNDICATE, LIMITED,

Petitioners and Complainants,

against

JAMES M. HYDE,

Respondent and Defendant.

ORAL ARGUMENTS AND ILLUSTRATIONS

Washington, D. C., Tuesday, October 1, 1916.

ARGUMENT OF MR. WILLIAM HOUSTON KENYON IN REPLY FOR PETITIONERS-COMPLAINANTS

Mr. Kenyon: May it please the Court, the question at issue, and the only question is the question of invention. Did the step that our patentees took constitute invention? The court below said no; it was simply a matter of degree. Respondent's counsel here defends that proposition by saying that our result is attained not by the diminution in the amount of oil, but by some trick of agitation, some novelty of agitation. I will address myself first to that latter proposition.

And the history of the birth of this invention is a complete answer to it. (Record pp. 446-448-451.)

If your Honors have not already marked those pages in the record, I will ask you to mark them; the whole of page 448, the whole of page 451, and, on page 445, the paragraph just below the middle, commencing "peripheral velocity of cone."

Contemporaneous documentary records, written within a few weeks of the birth of this invention—evidence of an extraordinary character of the birth of a most extraordinary invention. These inventors were working on the Cattermole process—which, as has been explained, agglutinates by oil in about three per cent. proportion the metal particles into bigger granules such that they sink against an upcurrent of water which carries the gangue up and away—the Cattermole process. They were experimenting with modifications of all the conditions of that process. Among them one line of investigation was as to the influence of changes of peripheral velocity. All sorts of variations, from 840 to 1,460, in the speed of the cone, were made, but the invention in issue was not born.

Another line of investigation was as to the influence of changes in the amount of oil (page 447, the seventh item). Out of that series of experiments (where the only change made from experiment to experiment was in the amount of oil—a gradual diminution in the amount of oil, all other things remaining the same) was born this invention.

Defendant's Exhibit No. 229.

And the record of it is right there on page 448 "Details of Experiments," the last column, "Remarks" "Float vastly increased"—tracing that back you see it was with three-tenths of one per cent. of oil; and just below "Float" again "vastly increased"—tracing that back it was with one-tenth of one per cent. of oil.

This float phenomenon appeared (page 451) when the oil had been reduced to about one-half of one per cent., said the inventors, after studying the process six weeks.

As the amount of oil was reduced granulation practically ceased at a range of about one-half of one per cent. of oil but a certain amount of black mineral froth was noticed. They were trying to send the values down, but they began to come up to the top.

Mr. Justice Day: Is that on page 451?

Mr. Kenyon: Page 451, the third paragraph.

> "A certain amount of black mineral froth was, however, noticed as a result. On successively decreasing the amount of oleic acid below .5 per cent. (that is one-half of one per cent.) it was found that whereas granulation ceased there was a growth in the amount of mineral float-froth under those conditions, and that the production of such float froth appeared to reach a maximum when about .1% of oleic acid on mineral was used."

If that evidence is true it disposes of the contention that this phenomenon which has revolutionized ore concentration the world over is to be explained as some trick of agitation.

Mr. Justice Day: How do we know that fact, that it has revolutionized ore concentration the world over?

Mr. Kenyon: How do we know it? This record shows that up to 1912 about $9,000,000 worth of values had been taken out, in Australia and Sweden and Chile, from dump heaps that had been valueless theretofore, by this process. The testimony that was taken in 1915 before Judge Bradford shows what had happened in the intervening three years, as pointed out in his opinion, during which three years an astounding development occurred in this country.

Mr. Justice McReynolds: I would like to ask you when in this process of reducing oil your invention came into existence.

Mr. Kenyon: At about one-half of one per cent. of oil.

Mr. Justice McReynolds: Before you got to the one-half of one per cent. did you have any invention?

Mr. Kenyon: We were passing from the region of Cattermole, which was a distinct—

Mr. Justice McReynolds: I want to know when your invention came into existence.

Mr. Kenyon: This invention was not reached, I should say, from those figures, until about .5, that is, one-half of one per cent., of oil was reached.

Mr. Justice McReynolds: At one per cent. you had no invention?

Mr. Kenyon: No.

Defendant's Exhibit No. 229.

Mr. Justice McReynolds: At one-half of one per cent. you did have invention?

Mr. Kenyon: It began to come. Remote, but it began to come. At .3 of one per cent. the float vastly increased. At .1 of one per cent. the float again vastly increased.

Mr. Justice McReynolds: When this float has more than one-half of one per cent. of oil it does not infringe?

Mr. Kenyon: It does not infringe.

Filed May 18, 1917.

GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Defend

CHI

Flotation Data for the Period

RETREA

DATE NOV.	Run	OILS USED Kind	Lbs. per Ton	% Solids	Weight Tons	Tot. % Cu.	% Cu. Oxide	% Fe.	% Insol.
1......	24	B-J	8.06	46.43	420	3.60	.42	17.8	65.9
2......	24	B-J-T	7.96	41.58	360	4.03	.39	13.1	74.8
3......	24	B-J-Ch	12.09	39.31	330	5.87	.29	13.5	64.6
4......	24	B-J	10.09	40.46	284	6.83	.19	11.1	70.1
5......	24	B-J	6.97	40.42	318	5.00	.50	11.5	71.2
6......	24	B-J	9.23	37.40	310	4.60	.24	15.3	64.8
7......	24	B-J	10.04	36.71	282	5.43	.20	12.8	69.1
8......	24	B-J	11.53	34.58	235	7.53	.18	9.2	75.4
9......	24	B-J	10.06	37.31	248	6.03	.21	12.3	69.3
10......	24	B-J	8.97	36.12	291	7.40	.36	12.1	70.4
11......	24	B-J	6.15	37.86	334	8.30	.38	12.0	69.9
12......	24	B-J	10.67	39.41	312	8.77	.41	9.1	72.3
13......	24	B-J	9.05	40.23	375	8.37	.27	7.1	75.4
14......	24	B-J	10.80	41.36	345	8.40	.17	10.2	69.6
15......	24	B-J	12.22	38.25	270	8.23	.14	10.0	69.7
16......	24	B-J	14.23	41.56	292	9.93	.20	16.0	59.0
17......	24	B-J	15.46	41.83	280	10.23	.17	12.7	65.2
18......	24	B-J	23.98	30.53	176	9.20	.24	10.7	68.1
19......	24	B-J	20.61	32.10	206	12.03	.27	10.5	66.0
20......	24	B-J	26.98	26.92	179	9.20	.20	9.6	70.7
21......	24	B-J	17.68	36.64	244	9.63	.28	10.8	65.2
22......	24	B-J	11.31	43.81	358	8.13	.39	20.0	54.5
23......	24	B-J	11.81	40.64	326	5.50	.41	19.2	60.3
24......	24	B-J	15.09	34.40	285	6.67	.17	15.1	64.4
25......	24	B-J	26.14	28.32	184	7.83	.45	9.2	72.5
26......	24	B-J	17.37	32.07	247	7.43	.25	14.1	65.7
27......	24	B-J	17.85	33.59	221	8.40	.19	19.5	56.9
28......	24	B-J	18.41	29.48	208	10.23	.11	11.4	66.1
29......	24	B-J	15.51	36.52	254	10.30	.10	9.8	67.5
30......	24	B-J	15.04	35.25	270	10.23	.25	11.1	65.3
Averages and totals..			13.71	37.03	8444	7.78	.27	12.6	67.3

NOTE—KINDS OF OIL USED—"B" signifies Barrett's No. 4 Creoso

Cost of
Cost of
Approxi
Approxi
Lbs. rea

NOTE—Reagents includes Na2S, Rosin and Caustic-Soda.
Dec. 10, 1916.
JDW

C:—F.G.J., W.H.J., J.M.S., F.R.W., FILE.

Copied at Butte, Mont., May 2, 1917.

b. 230.

ANY

November 30th, Inclusive, 1916.

NTRATES

GS		CONCENTRATES				Ratio of Conct.	% Ind. Recov.	Lbs. Used of Re-agents
% Cu. Oxide	% Fe.	Weight Tons	Tot. % Cu.	% Fe.	% Insol.			
.13	13.4	105.76	13.37	26.6	33.1	3.99	93.13	1000
.13	10.4	72.43	18.97	23.3	34.0	4.97	94.65	1100
.08	10.9	96.77	19.43	21.4	30.3	3.41	97.11	1664
.07	7.5	82.32	23.13	23.1	24.7	3.45	98.23	915
.13	6.9	82.17	18.70	23.8	26.9	3.87	96.59	2464
.05	9.1	82.45	16.40	25.1	26.3	3.76	94.73	1697
0	10.4	75.60	19.70	25.9	24.4	3.73	97.17	1771
.01	5.6	66.20	26.43	21.0	26.5	3.55	98.76	973 8
.02	13.5	58.08	24.53	22.2	22.7	4.27	95.17	924
0	20.4	82.44	25.70	20.4	29.9	3.53	98.45	1573
.04	11.6	94.90	28.87	19.0	30.9	3.53	98.45	1643
.10	10.9	89.66	29.73	16.8	28.5	3.48	97.40	1672
.04	6.2	88.24	34.60	13.9	27.4	4.25	97.17	922
.08	8.6	92.99	30.40	15.8	29.3	3.71	97.48	1565
0	7.9	84.91	25.40	19.2	28.2	3.18	96.92	1646
.08	15.5	115.41	24.83	17.4	33.5	2.53	98.66	1676
.05	12.5	89.46	31.63	17.2	26.1	3.13	98.67	883
.07	8.9	50.00	31.70	16.8	25.9	3.52	97.98	926
.07	8.9	70.79	34.50	14.8	26.2	2.91	98.42	1707
.05	5.4	69.11	23.60	17.0	33.7	2.59	98.86	923
.07	7.8	91.04	25.40	18.8	28.1	2.68	98.37	1586
.13	14.3	116.61	24.00	24.9	20.8	3.07	96.19	922
.10	16.0	91.83	18.60	29.0	21.5	3.55	95.17	1619
.11	12.4	93.75	18.63	27.4	23.5	3.04	91.95	839
.09	3.9	69.96	19.97	21.1	37.3	2.63	97.15	1576
.15	7.5	91.82	19.23	24.2	30.2	2.69	96.19	817
.08	11.6	105.74	16.77	33.5	22.5	2.09	95.34	1620
.06	4.8	98.11	21.40	21.7	34.4	2.12	98.50	909
0	4.7	101.60	25.23	17.1	37.9	2.50	98.14	853
.07	5.5	101.80	26.43	20.6	26.6	2.65	97.50	1625
.07	9.8	2611.95	23.91	21.3	28.4	3.16	97.19	40015

Turpentine; "CH" Chesapeake Pine.

ial treated .... .3125
material treated .... .2086
month $2,638.98
nts for month 1,762.21
of material treated 4.74

(Signed) O. WISER,
Metallurgical Engineer.

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Defendant's Exhibit No. 231.

CHINO COPPER COMPANY

HURLEY PLANT

Rosin and Reagents Used in Vanner Concentrate Flotation Plant During November, 1916.

DATE	Rosin Pounds	Sodium Sulphide Pounds	Caustic Soda Pounds	Total
1	270	700	30	1000
2	84	1000	16	1100
3	160	1474	30	1664
4	150	735	30	915
5	233	2184	47	2464
6	200	1457	40	1697
7	270	1451	50	1771
8	200	738	40	978
9	170	724	30	924
10	100	1453	20	1573
11	170	1443	30	1643
12	170	1472	30	1672
13	170	722	30	922
14	100	1445	20	1565
15	170	1446	30	1646
16	200	1446	30	1676
17	134	723	26	883
18	170	726	30	926
19	200	1467	40	1707
20	170	723	30	923
21	135	1426	25	1586
22	170	722	30	922
23	170	1419	30	1619
24	100	719	20	839
25	100	1456	20	1516
26	68	737	12	817
27	135	1460	25	1620
28	150	729	30	909
29	100	733	20	853
30	135	1465	25	1625

Copied from
Original Record
May 2, 1917.

F. R. WICKS,
Asst. Supt. of Mills.

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Defendant's Exhibit No. 232.

2—396

DEPARTMENT OF THE INTERIOR,

UNITED STATES PATENT OFFICE

To all persons to whom these presents shall come, Greeting:

THIS IS TO CERTIFY, That the annexed is a true copy of the only instrument of Writing found of Record from June 19, 1909, up to and including April 7, 1917, which may affect the title of the

Letters Patent of

James M. Hyde,

Number 1,022,085, Granted April 2, 1912,

for

Improvement in Art of Concentration of Mineral Substances.

Recorded in Liber and page as designated on the margin of said Instrument.

Said record has been carefully compared with the original and is a correct transcript of the whole thereof.

IN TESTIMONY WHEREOF I have hereunto set my hand and caused the seal of the Patent Office to be affixed at the City of Washington, this 24th day of April, in the year of our Lord one thou-

Defendant's Exhibit No. 232.

sand nine hundred and seventeen, and of the Independence of the United States of America the one hundred and forty-first.

F. W. H. CLAY,
Acting Commissioner of Patents.

Patent Office
United States of America
(Seal)
Liber X 91
Page 300

WHEREAS, I, James M. Hyde, formerly of Basin, Montana, and now of Berkeley, California, did obtain letters patent of the United States for improvement in Art of Concentration of Mineral Substances, which letters patent are numbered 1,022,085, and bear date the 2nd day of April, 1912; and whereas, I am now the sole owner of the said patent and of all rights under the same in the below-recited territory; and whereas Butte and Superior Copper Company, Limited, an Arizona corporation, is desirous of acquiring an interest in the same;

NOW THEREFORE, to all whom it may concern, be it known that, for and in consideration of the sum of One ($1.00) Dollar, and other valuable consideration, to me in hand paid, the receipt of which is hereby acknowledged, I, the said James M. Hyde, have sold, assigned, and transferred, and by these presents, do sell, assign and transfer unto the said Butte and Superior Copper Company, Limited, all the right, title and interest in and to the said invention, as secured to me by said letters patent, for, to and in the County of Silver Bow, State of Montana, and for, to, or in said place or places; the same to be held and enjoyed by the said Butte and Superior Copper Company, Limited, within and throughout the above specified territory, but not elsewhere, for its own use and behoof, and for the use and behoof of its legal representatives or its assigns, to the full end of the term for which said letters patent are or may be granted, as fully and entirely as the same would have been held and enjoyed by me had this assignment and sale not been made. It being the intent hereof that the rights acquired by the Butte and Superior Copper Company, Limited, hereunder may at any time be assigned by the said Butte and Superior Copper Company, Limited, to others.

It is the intent of the said James M. Hyde to assign and transfer to the Butte and Superior Copper Company, Limited, an Arizona corporation, conducting a mining and milling business in Butte, Montana, the exclusive right of treating by my process all ores mined in Silver Bow County, Montana, or shipped into Silver Bow County, Montana, or whether milled in said Silver Bow County, Montana, or outside thereof.

IN TESTIMONY WHEREOF, I have hereunto set my hand and affixed my seal at Butte, in the County of Silver Bow, and State of Montana, this 19 day of April, 1913.

James M. Hyde.

Defendant's Exhibit No. 232.

STATE OF MONTANA,
COUNTY OF SILVERBOW } ss:

On this 19 day of April, 1913, before me, the undersigned, a Notary Public, in and for the State of Montana, residing at Butte, Montana, personally appeared James M. Hyde, known to me to be the person whose name is subscribed to the foregoing instrument, and acknowledged to me that he executed the same.

IN WITNESS WHEREOF, I have hereunto set my hand and affixed my Notarial seal the day and year in this certificate first above written.

LOUIS P. SANDERS
NOTARIAL SEAL
STATE OF MONTANA
Recorded May 7, 1913.

Louis P. Sanders
Notary Public, in and for
the State of Montana,
residing at Butte, Montana. My commission
expires July 17, 1915.

Filed May 18, 1917.

GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Plaintiffs' Exhibit No. 233.

Admitted.

Basin, Montana,
September 5, 1911.

Mr. W. A. Clark, Jr.,
Los Angeles, Cal.

Dear Sir:

The fifty ton test plant has now run satisfactorily for such a length of time that I am warranted in assuring you that my adaptation of the gas bubble flotation process is a pronounced success in treating the ore of the Black Rock Mine.

By permission of Mr. Atwater, I enclose herewith a copy of a recent report presented to him; and also refer you to him for a verification of my statements and for any further information you may desire concerning the results of the work we have been doing at Basin.

Since the completion of the machine by the addition of the cleaner, which was part of the original plan, all of the concentrates produced have been of good marketable grade. On two or three occasions the feed has been too coarse for the process, and the concentrate has been of lower grade because of attached particles of silica. Mr. Pratt's samples were taken on one of these occasions. Our shipments of flotation concentrates have steadily increased in grade. Four carloads have averaged as follows:—48.6, 49.6, 51.0, 51.7.

Plaintiffs' Exhibit No. 233

The mill has run a slime department similar to yours with practically the same results which you have obtained. All of the material formerly treated in the slime department is now being treated by the flotation process. We have also treated the accumulated slimes concentrate, raising the grade of the same from about 41% to over 53%.

Mr. Siderfin and Mr. Pratt have visited the plant independently and we gave them samples taken in their presence. On both occasions the machine was just being started up. The first tailings sample was taken in each case before the machine was doing its best work.

I enclose herewith a copy of a letter sent to Mr. Siderfin at his request, and make the following quotation from a letter received from him— "The returns for the samples which I brought back with me are shown on the following page:—

	% Zinc
Heads	20.4
Tails	4.0
Tails No. 2	2.3
Concentrates	52.9

"Mr. Pratt seems to have been quite pleased with the results you were getting on the machine, and has had the samples that he brought back tested with the following results:

Plaintiffs' Exhibit No. 233

	% Zinc.	Ozs. Silver.
Feed	17.0	8.8
Tails	3.6	2.4
Tails No. 2	1.6	1.6
Concentrates	44.7	19.5"

The Butte and Superior Co. is so pleased with the results accomplished that they are now remodelling their plant to provide for fine grinding of the jig tailings and treating them and all of the slimes by the flotation process. The new machine should be running in less than a month from now. They are also getting out plans for a 500 ton mill to be erected at once. I am assisting in getting out these plans.

The patent phase of the situation has been gone into very thoroughly by their local attorneys who have submitted the matter to one of the best firms of patent attorneys in the country, whose report has not yet been received. As the company is going ahead with the use of the process here and are designing the new mill to use it, it is apparent that their investigation has led them to be certain that the threats of litigation have been mere bluffs made in an attempt to make them pay an exorbitant price.

I saw Mr. Pyle in Butte a few days ago and told him that I thought I should wait until the larger machine was working before communicating with you.

I am anxious to get my family away from here before the cold weather sets in. It now appears that things are likely to shape themselves so that we can leave for California in six or seven weeks. There-

Plaintiffs' Exhibit No. 233

fore I have considered it best to inform you of the complete success of the operations here, and to inform you that it is possible to complete an installation for you within four or five weeks if you care to proceed with the matter at once.

My agreement with the Butte and Superior Co. provides for me to be paid in proportion to the extra profit which they make as a result of the use of the flotation process. They expect my compensation to amount of $30,000, on the basis of $1,000 for each $600 extra profit made in a 30 day run.

As your tonnage treated is about one half of theirs and they have borne all of the expense of proving the process a phenomenal success in treating this ore, I prefer to deal with you on the following basis.

If you appoint me as consulting engineer for this work, I will plan and supervise the construction and starting of a flotation machine capable of treating the amount of ore you are now milling. I will leave a man with you who is competent to handle the machine satisfactorily. If you wish me to do so I will act as consultant for you in relation to the work carried on in your Butte mill for one year, without further compensation than the fee herein stated.

I will expect my fee to be $15,000, to be paid as follows—$5,000 when the agreement is drawn up and $10,000 when the machine is completed.

These terms would apply only if the work is to be undertaken at once.

The machinery and construction work necessary should not cost more than $4,000 or $5,000 unless you instal tube mills at an additional cost of $5,000 to $6,000. It is very possible that your Chili mills will grind fine enough so that tube mills will not be needed.

Mr. Atwater will assure you that my estimates of costs and recoveries have been conservative.

Hoping to have an early reply, I remain

Respectfully yours

(Signed) James M. Hyde.

P. S. I will consider it a favor if you do not mention the terms of my contract with the Butte & Superior Co. to anyone.

J. M. H.

Filed May 18, 1917.

GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Defendant's Exhibit No. 234.

2-390

UNITED STATES OF AMERICA

DEPARTMENT OF THE INTERIOR,

United States Patent Office.

To all to whom these presents shall come, Greeting:

THIS IS TO CERTIFY that the Records of this Office show that no disclaimer was filed in the United States Patent Office of any claims in Letters Patent of the United States Number 835,120 granted November 6, 1906, to Henry Livingston Sulman, Hugh Fitzalis Kirkpatrick-Picard and John Ballot until March 28, 1917, and that no other disclaimer has been filed than the disclaimer filed on said date of which the attached is a true copy.

IN TESTIMONY WHEREOF I have hereunto set my hand and caused the seal of the Patent Office to be affixed at the City of Washington, this 17th day of April, in the year of our Lord one thousand nine hundred and seventeen and of the Independence of the United States of America the one hundred and forty-first.

T. W. H. CLAY

Acting Commissioner of Patents.

Defendant's Exhibit No. 234

$10.00 REC'D
MAR 28 1917 H
C. C. U S PAT. OFFICE

Disclaimer Recorded March 28, 1917.

UNITED STATES PATENT OFFICE.

Hon. Commissioner of Patents,

Sir:

Your Petitioner, Minerals Separation, Limited, a Corporation organized and existing under the laws of Great Britain and having its principal place of business in London, England, hereby represents as follows:

1. That on November 6th, 1906, Letters Patent of the United States for Ore Concentration, No. 835.120, were granted to Henry Livingstone Sulman, Hugh Fitzalis Kirkpatrick-Picard and John Ballot, of London, England, and your Petitioner is now the sole and exclusive owner of the said Letters Patent.

2. That by the decision of the Supreme Court of the United States in Minerals Separation, Limited, and Minerals Separation American Syndicate, Limited, vs. James M. Hyde, filed the 11th day of December, 1916, your Petitioner is advised that the said Letters Patent No. 835,120, in so far as concerns Claims 9, 10 and 11 thereof, covers and includes more than the said inventors had a right to claim as new.

3. That the matter which the said patentees and

Defendant's Exhibit No. 234

your Petitioner are, in accordance with the said decision of the said Court, not entitled to hold or claim by virtue of said claims 9, 10 and 11 of said Letters Patent No. 835,120, was included therein by mistake, and without fraudulent or deceptive intent, and without any willful default or intent to defraud or mislead the public.

4. That the subject-matter not herein and hereby disclaimed is definitely distinguishable from the part or parts disclaimed herein, and is truly and justly the invention of the said Henry Livingstone Sulman, Hugh Fitzalis Kirkpatrick-Picard and John Ballot, and is a material and substantial part of the thing patented.

Your petitioner, therefore, for the purpose of complying with the requirements of the law in such case made and provided, and of disclaiming those parts of the thing patented which your Petitioner does not choose to claim or hold by virtue of said Letters Patent No. 835,120, does hereby disclaim from claims 9, 10 and 11 of said Letters Patent No. 835,120, any process of concentrating powdered ores excepting where the results obtained are the results obtained by the use of oil in a quantity amounting to a fraction of one per cent on the ore.

IN WITNESS WHEREOF your Petitioner has caused these presents to be signed and sealed by John Ballot, its duly constituted attorney in fact under and by virtue of a power of attorney dated December 14, 1915, and recorded in the United States Patent Office November 27, 1916, in Liber K 101, page 176 of

Defendant's Exhibit No. 234

Transfers of Patents, this 27th day of March, 1917.

Minerals Separation Limited
by John Ballot
Attorney in fact

In presence of:
S. Gregory,
Henry D. Williams

STATE OF NEW YORK,
County of New York,—ss:

On this 27th day of March, 1917, before me personally came John Ballot, attorney in fact of Minerals Separation Limited, a Company organized under the laws of Great Britain, to me personally known, and known to me to be the individual described and who, as such attorney, executed the within petition and acknowledged that he executed the same as the act and deed of Minerals Separation, Limited, therein described, by virtue of a power of attorney duly executed by said Minerals Separation, Limited, bearing date December 14, 1915, which power of attorney was exhibited to me, and he stated that it was still in force and effect.

Harry C. Lewis,
Notary Public Bronx Co. No. 12.
Certificate filed in New York
Seal. County No. 41.

Filed May 18, 1917.

GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Defendant's Exhibit No. 235.

BUTTE & SUPERIOR MINING COMPANY

REPORT NO. 118.

APRIL 28TH

General Flotation Operation:—

The oils used were:—

Standard Yaryan Pine	18.53% of total oil
Fuel Oil	70.62% of total oil
Commercial Kerosene	10.85% of total oil

Period of Operation	24 hours
Flotation feed tonnage, 24 hrs.	1262 dry tons
Flotation concentrates produced	300 dry tons
Temperature of feed	Atmospheric
Dilution of feed	4.93 : : 1

OILS AND REAGENTS USED

Pine Oil lb./Ton	Fuel Oil lb./Ton	Commercial Kerosene lb./Ton	Sulphuric Acid lb./Ton	Copper Sulphate A.C.M. Solution lb./Ton
3.69	14.05	2.16	11.11	(a) 5.92

(a) Equivalent to 0.09 pounds metallic copper per ton.
Metallic copper consumed 113.62 pounds

Actual initial oil added:—

Commercial Kerosene	2,725	pounds
Fuel Oil	17,737	"
Standard Yaryan Pine	4,655	"
Actual initial oil added	25,117	"
Initial oil added per ton	19.90	"

Defendant's Exhibit No. 235

BUTTE & SUPERIOR MINING COMPANY

REPORT NO. 118

APRIL 28TH

The assay results and oil analyses for this date are as follows:—

	Flotation Feed Including Circulating Load		Tailing		Concentrate	
	Assay % Zn.	Analysis % Oil	Assay % Zn.	Analysis % Oil	Assay % Zn.	Analysis % Oil
7-3 Shift	15.8	1.55	1.81	0.63	41.9	2.21
3-11 "	15.0	1.59	1.39	.45	42.5	2.89
11-7 "	12.5	1.88	1.45	.71	43.8	3.31
Average	(b)14.43	(b)1.67	(a)1.56	(b) .60	(a)42.8	(b)2.80

(a)—Assay composites
(b)—Numerical averages

BUTTE & SUPERIOR MINING COMPANY

REPORT NO. 119

APRIL 29TH

General Flotation Operation:—

1st Period—7:00 A. M. to 1:00 P. M. and 5:00 P. M. to 7:00 A. M.

The oils used were:—

Commercial Kerosene	11.23% of total oil
Fuel Oil	64.47% of total oil
Standard Yaryan Pine	24.30% of total oil
Period of Operation	20 Hours
Tonnage treated per 20 hours	1239.47 dry tons
Flotation concentrate produced	282.84 dry tons
Temperature of feed	Atmospheric
Dilution of feed	3.97 : : 1

Defendant's Exhibit No. 235

OILS AND REAGENTS USED

Commercial Kerosene lb./Ton	Fuel Oil lb./Ton	Pine Oil lb./Ton	Sulphuric Acid lb./Ton	Copper Sulphate A.C.M. Solution lb./Ton
2.67	15.32	5.77	6.87	(a) 6.27

(a) Equivalent to 0.10 pounds metallic copper per ton
Metallic copper consumed 118.09 pounds
Initial oil added per ton 23.76 pounds.

BUTTE & SUPERIOR MINING COMPANY

REPORT NO. 119

APRIL 29TH

General Flotation Operation:—

2nd Period—1:00 P. M. to 5:00 P. M.

The oils used were:—

Commercial Kerosene	11.23% of total oil
Fuel Oil	64.47% of total oil
Standard Yaryan Pine	24.30% of total oil
Period of operation	4 hours
Tonnage treated per four hours	263.53 dry tons
Flotation concentrate produced	60.16 dry tons
Temperature of feed	Atmospheric
Dilution of feed	3:45 : : 1

OILS AND REAGENTS USED

Commercial Kerosene lb./Ton	Fuel Oil lb./Ton	Pine Oil lb./Ton	Sulphuric Acid lb./Ton	A.C.M. Solution Copper Sulphate lb./Ton
2.96	17.00	6.41	7.08	(a) 6.50

(a) Equivalent to 0.10 pounds metallic copper per ton
Metallic copper consumed 26.02 pounds
Initial oil added per ton 26.37 pounds

HJS:JDS

Defendant's Exhibit No. 235

BUTTE & SUPERIOR MINING COMPANY

REPORT NO. 119

APRIL 29TH

Actual initial oil added during 24 hours period:—

1st Period—7:00 A. M. to 1:00 P. M. and 5:00 P. M. to 7:00 A. M.

Commercial Kerosene	3,306	pounds
Fuel Oil	18,988	pounds
Standard Yaryan Pine	7,155	pounds
Total	29,449	pounds

2nd Period—1:00 P. M. to 5:00 P. M.

Commercial Kerosene	780	pounds
Fuel Oil	4,479	pounds
Standard Yaryan Pine	1,689	pounds
Total	6,948	pounds

Total actual initial oil added	36,397	pounds
Total actual initial oil added per Ton	24.21	pounds

HJS:JDS

Defendant's Exhibit No. 235

BUTTE & SUPERIOR MINING COMPANY

REPORT NO. 119

APRIL 29TH

The assay results and oil analysis for this date are as follows:—

1st Period—7:00 A. M. to 1:00 P. M. and 5:00 P. M. to 7:00 A. M.

	Flotation Feed Including Circulating Load.		Tailing.		Concentrate.	
	Assay % Zn.	Analysis % Oil.	Assay % Zn.	Analysis % Oil.	Assay % Zn.	Analysis % Oil.
7:00 A.M.– 1:00 P.M.	12.1	2.34	1.19	1.29	44.3	3.18
5:00 P.M.–11:00 P.M.	13.7	2.62	1.69	1.18	46.8	4.72
11:00 P.M.– 7:00 A.M.	13.9	1.88	1.57	1.47	45.2	3.31
Average......	(*a*) 13.2	(*a*) 2.28	(*b*) 1.55	(*a*) 1.31	(*b*) 45.6	(*a*) 3.74

2nd Period—1:00 P. M. to 5:00 P. M.

	Flotation Feed Including Circulating Load		Tailing		Concentrate	
	Assay % Zn.	Analysis % Oil	Assay % Zn.	Analysis % Oil	Assay % Zn.	Analysis % Oil
1:00 P. M. to 5:00 P. M.	12.6	1.77	1.57	0.67	45.2	3.13

HJS:JDS

Defendant's Exhibit No. 235

BUTTE & SUPERIOR MINING COMPANY

REPORT NO. 120

APRIL 30TH

General Flotation Operation:—

The Oils used were:—

Standard Yaryan Pine	9.68% of total oil
Fuel Oil	78.58% of total oil
Commercial Kerosene	11.74% of total oil
Period of operation	24 hours
Flotation feed tonnage 24 hours	1608 dry tons
Flotation concentrates produced	383 dry tons
Temperature of feed	Atmospheric
Dilution of feed	3.53 : : 1

OILS AND REAGENTS USED

Pine Oil lb./Ton	Fuel Oil lb./Ton	Commercial Kerosene lb./Ton	Sulphuric Acid lb./Ton	Copper Sulphate A.C.M. Solution lb./Ton
2.61	21.16	3.16	6.46	(a) 6.80

(a) Equivalent to 0.10 pounds metallic copper per ton

Metallic copper consumed	166.12 pounds
Actual Initial Oil added:—	
Commercial Kerosene	5,085 pounds
Fuel Oil	34,027 pounds
Standard Yaryan Pine	4,189 pounds
Total	43,301 pounds
Initial oil added per ton	26.93 pounds

Defendant's Exhibit No. 235

BUTTE & SUPERIOR MINING COMPANY

REPORT NO. 120

APRIL 30th

The assay results and oil analyses for this date are as follows:

	Flotation Feed Including Circulating Load		Tailing		Concentrate	
	Assay % Zn.	Analysis % Oil	Assay % Zn.	Analysis % Oil	Assay % Zn.	Analysis % Oil
7-3 Shift	13.3	1.87	1.72	0.69	42.8	3.42
3-11 "	12.5	2.08	1.44	0.73	42.7	4.05
11-7 "	18.6	1.74	2.52	1.36	43.6	4.26
Average	(b) 14.8	(b) 1.90	(a) 1.92	(b) .93	(a) 43.4	(b) 3.91

(a)—Assay composites
(b)—Numerical averages

HJS:JDS

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Plaintiffs' Exhibit No. 236.

UNITED STATES DISTRICT COURT,
DISTRICT OF MONTANA.

MINERALS SEPARATION, LIMITED,
Plaintiff,

vs.

BUTTE & SUPERIOR MINING COMPANY,
Defendant.

STATE OF NEW YORK, }
County of New York. } ss:

HARRY FALCK, being duly sworn, deposes and says:

I am a resident of the City of New York, State of New York, and am the general office manager for Beer, Sondheimer & Co. Inc., the American agents for Minerals Separation Ltd., the plaintiff in this action.

It is a part of my duty as office manager for said Beer, Sondheimer & Co. Inc. to be familiar with the granting of licenses by Minerals Separation Ltd. in this country and the payment of royalties thereunder. It is my duty to receive the statements of returns rendered by the licensees of the patent here in suit to the plaintiff herein, and to prepare bills based on such statements if correct for royalties due under the licenses and to keep account of the royalties paid to Beer, Sondheimer & Co. Inc. as agents for the plain-

Plaintiffs' Exhibit No. 236

tiff. I have prepared a statement giving the name of each licensee, the period during which the process of the patent in suit has been carried on by such licensee, the number of tons of material treated, or the number of tons of concentrates recovered, and the amount of royalties paid to Minerals Separation Ltd. by such licensee which is hereto annexed. These figures are taken from the statement of returns rendered to Minerals Separation Ltd. by the licensees and from the books of Beer, Sondheimer & Co. Inc., and have been carefully checked by me, and are true and correct.

Subscribed and sworn to before
me this 10th day of April, 1917
(Seal)

Harry Falck.

Harry C. Lewis

Notary Public, Bronx Co. No. 11

Certificate filed in New York County No. 93.

Plaintiffs' Exhibit No. 236

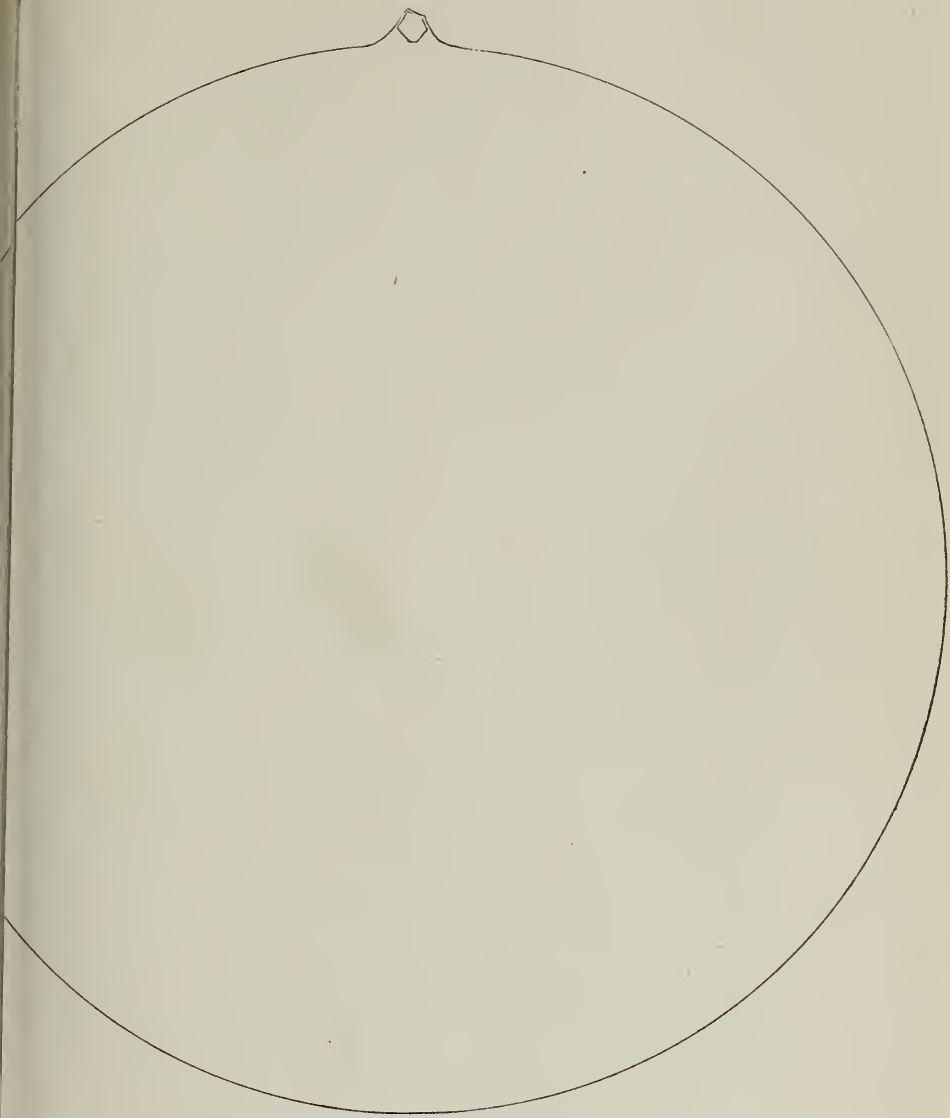
TABLE OF RETURNS AND PAYMENTS OF ROYALTIES BY UNITED STATES LICENSEES OF MINERALS SEPARATION, LIMITED

NAME	Period	Tonnage Material Treated	Tonnage Concentrates Recovered	Amount
Inspiration Cons. Copper Co.	Jan. /14 to June 30/15	257270.4	Not Reported	$30871.36
Consolidated Arizona Smelt. Co.	June /14 to Jan. /17	197952.65	Not Reported	26595.24
Atlas Min. & Milling Co.	Oct. /13 to Dec. 31/16	102596.50	Not Reported	14730.27
Anaconda Copper Mining Co. Cananea Cons. Copper Co. Inspiration Cons. Copper Co. Arizona Copper Company, Ltd.	Apr. 1/15 to Dec. 31/16	11785189.3455	Not Reported	536826.60
Mountain Copper Company, Ltd.	Apr. 1/15 to Dec. 31/16	98573.10	Not Reported	12847.12
Engels Copper Mining Company	Jan. 1/15 to Dec. 31/16	200135.34	Not Reported	26644.21
Utah Leasing Company	Nov. /15 to Dec. 31/16	175923.00	Not Reported	10555.38
Colusa Parrot Min. & Smelt. Co.	July /16 to Jan. /17	69798.9635	Not Reported	4188.00
Chichagoff Mining Company	July 1/16 to Dec. 31/16	13094.00,	Not Reported	1309.40
Stoddard Milling Company	Aug. 14/16 to Dec. 31/16	14716.00	Not Reported	3769.00
Goldfield Cons. Mines Co.	Mar. /16 to Nov. /16	37789.00	Not Reported	7557.80
Elm Orlu Mining Company	June 26/14 to Dec. 31/16	Not Reported	121630.713	141627.68
St. Joseph Lead Company	Apr. 1/14 to Dec. 31/16	Not Reported	42550.747	26271.39
Doe Run Lead Company	Apr. /14 to Dec. 31/16	Not Reported	23516.759	18217.08
Desloge Cons. Lead Company	Jan. 1/16 to Dec. 31/16	Not Reported	5337.945	4689.89
Maxwell W. Atwater	June 22/14 to Sep. 30/16	Not Reported	10643.155	13303.93
McDonald & Noble	Oct. /13 to Dec. 31/16	Not Reported	9418.000	5602.68
Weedon Mining Company	July 23/15 to June 1/16	Not Reported	1225.00	833.00
Butte Central Min. & Mill. Co.	to Mar. 1/17	Not Reported	588.646	990.00
Napoleon Mining Company	Oct. 1/15 to June 30/16	Not Reported	430.929	298.38
Dutch Sweeney Mining Company	Dec. /16 to Feb. /17	Not Reported	2126.45 Oz. Au.	531.61
Portland Gold Mining Company	Nov. /15 to Sep. 30/16	Not Reported	9602.5779 Oz. Au.	2400.64
				$1155258.24

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Plaintiffs' Exhibit No. 237.

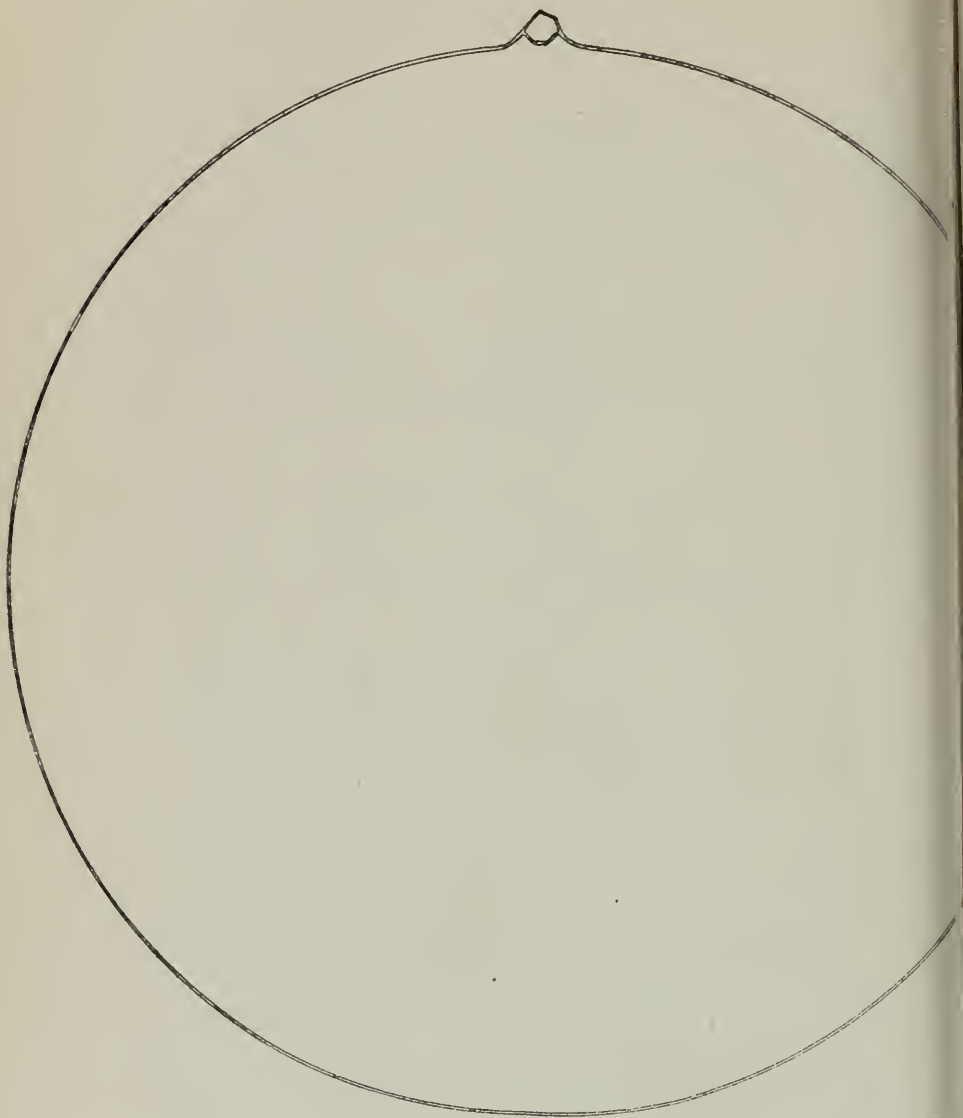
Diagram No. 1



Filed August 15, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Plaintiffs' Exhibit No. 238.

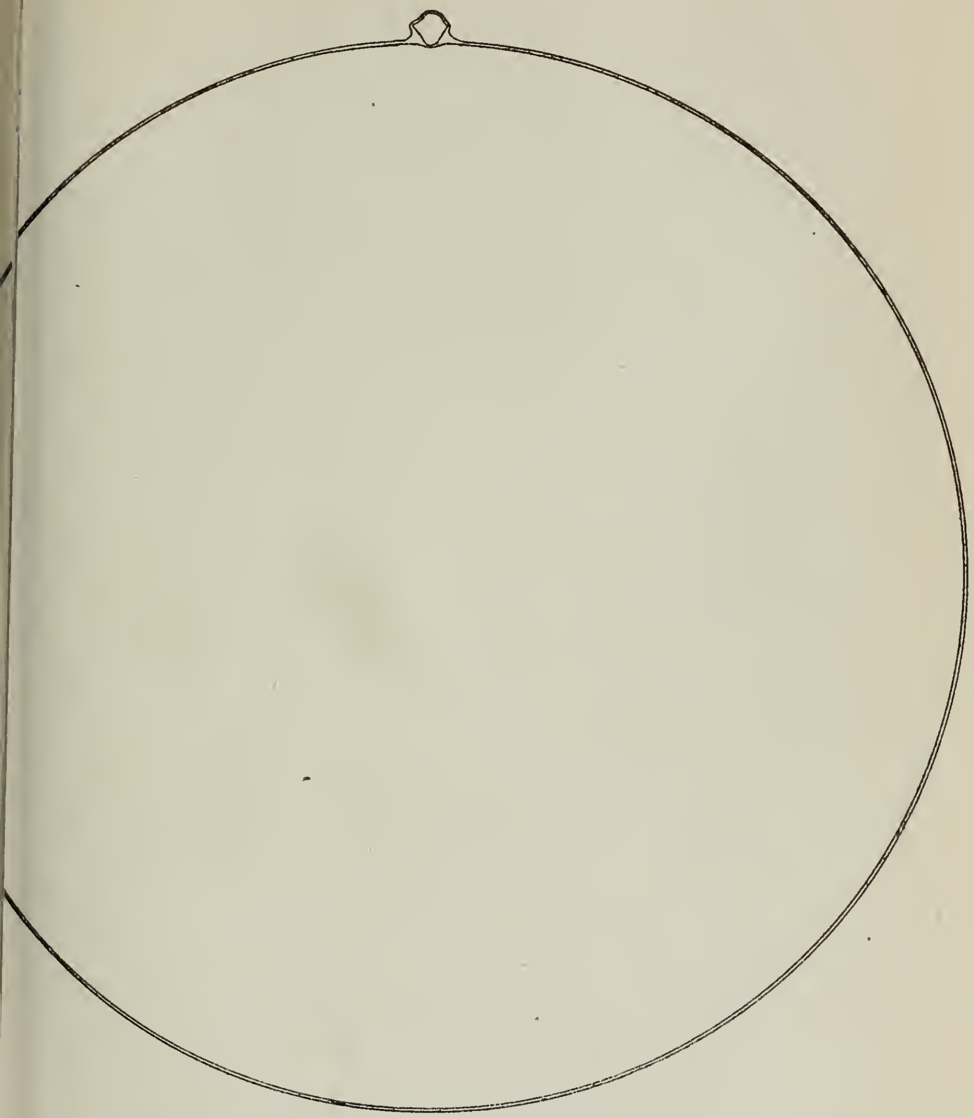
Diagram No. 2



Filed August 15, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Plaintiffs' Exhibit No. 239.

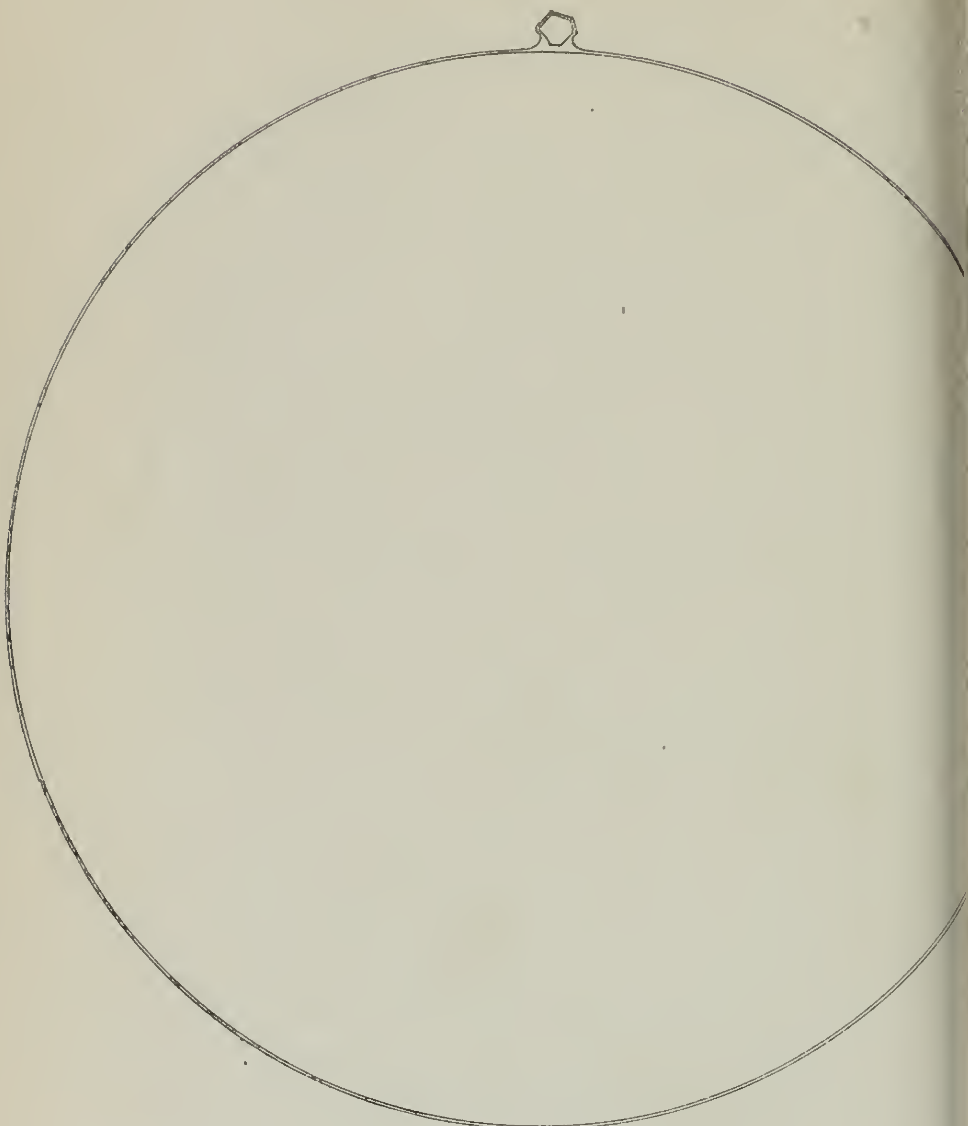
Diagram No. 3



Filed August 15, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

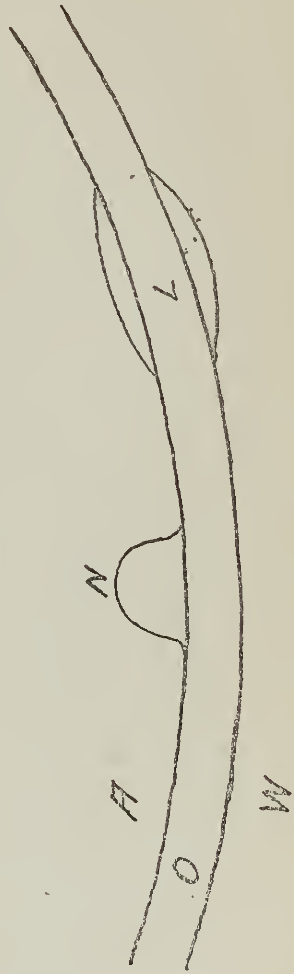
Plaintiffs' Exhibit No. 240.

Diagram No. 4



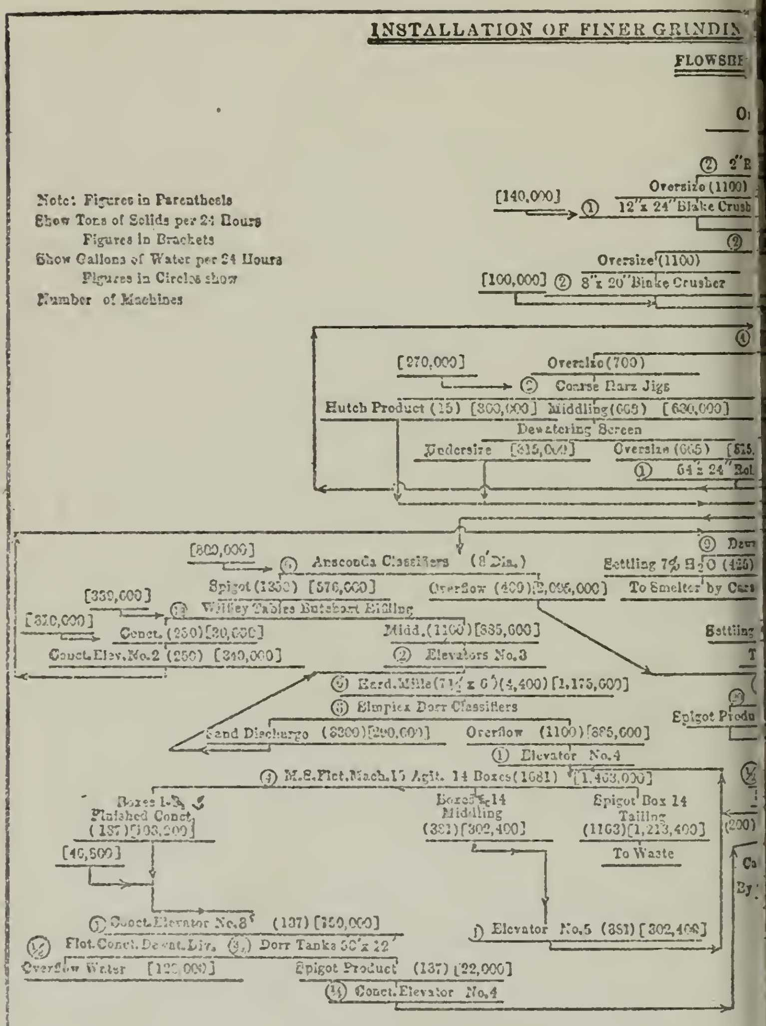
Filed August 15, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

DIAGRAM NO. 5—PLAINTIFF'S EX



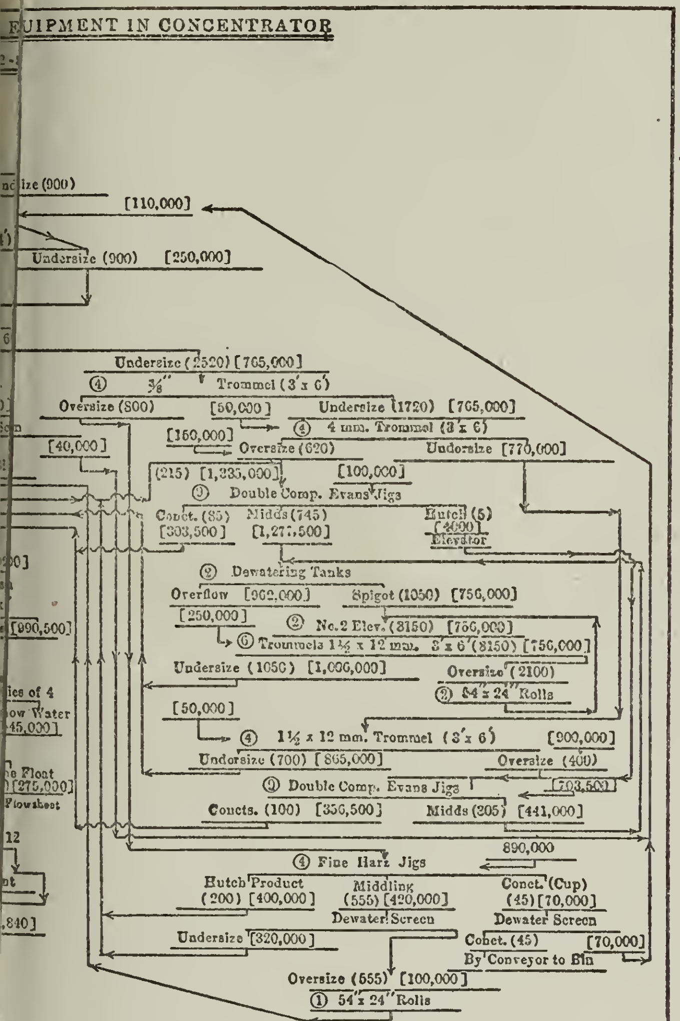
Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Plainti


INSTALLATION OF FINER GRINDIN
FLOWSHE
Note: Figures in Parenthesis
Show Tons of Solids per 24 Hours
Figures in Brackets
Show Gallons of Water per 24 Hours
Figures in Circles show
Number of Machines
[140,000] ① 12"x 24" Blake Crush
Oversize (1100)
[100,000] ② 8"x 20" Blake Crusher
Oversize (1100)
[270,000]
Oversize (700)
Coarse Harz Jigs
Hutch Product (15) [300,000] Middling (665) [630,000]
Dewatering Screen
Undersize [315,000] Oversize (665)
Anaconda Classifiers (8' Dia.)
Spigot (1350) [576,000] Overflow (400) [2,096,000]
Settling 7% H2O (425)
To Smelter by Cars
Wilfley Tables Butchart Riffling
Concent. (250) [30,000] Midd. (1100) [885,600]
Concet. Elev. No. 2 (250) [340,000]
② Elevators No. 3
Hard. Mills (7½' x 6') (4,400) [1,175,600]
Simplex Dorr Classifiers
Sand Discharge (3300) [290,000] Overflow (1100) [885,600]
① Elevator No. 4
M.S. Flot. Mach. 15 Agit. 14 Boxes (1681) [1,403,000]
Finished Conct.
Middling (381) [302,400]
Spigot Box 14
Tailing (1163) [1,213,400]
To Waste
[46,800]
Conct. Elevator No. 8 (137) [350,000]
Elevator No. 5 (381) [302,400]
Flot. Conct. Dewat. Div. Dorr Tanks 50' x 12'
Overflow Water
Epigot Product (137) [22,000]
Conct. Elevator No. 4
Epigot Produ

N. 242.

FLOTATION CONCENTRATION AT ANACONDA, MONT.

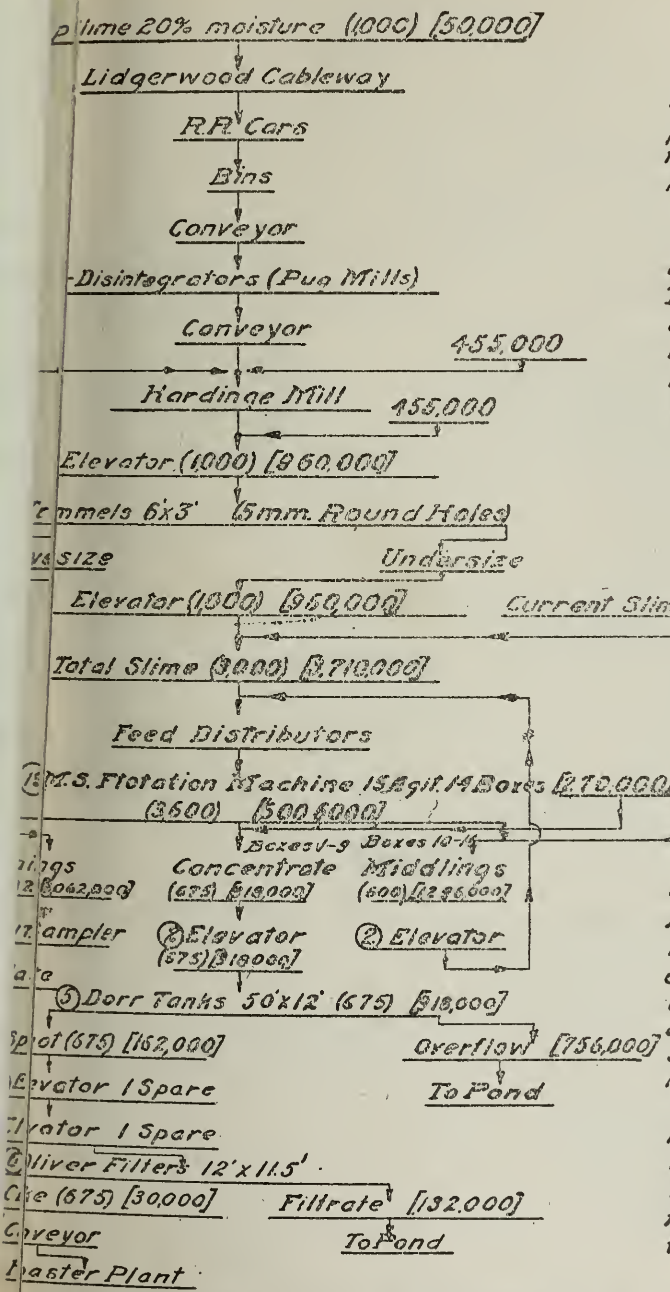


Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Plaintiffs' Exhibit No. 243.

ANACONDA COPPER MINING CO.

SLIME FLOTATION PLANT AT ANACONDA



Notes:—

This flow sheet shows the current slime and pond slime mixed together for treatment. They may, however, be treated separately.

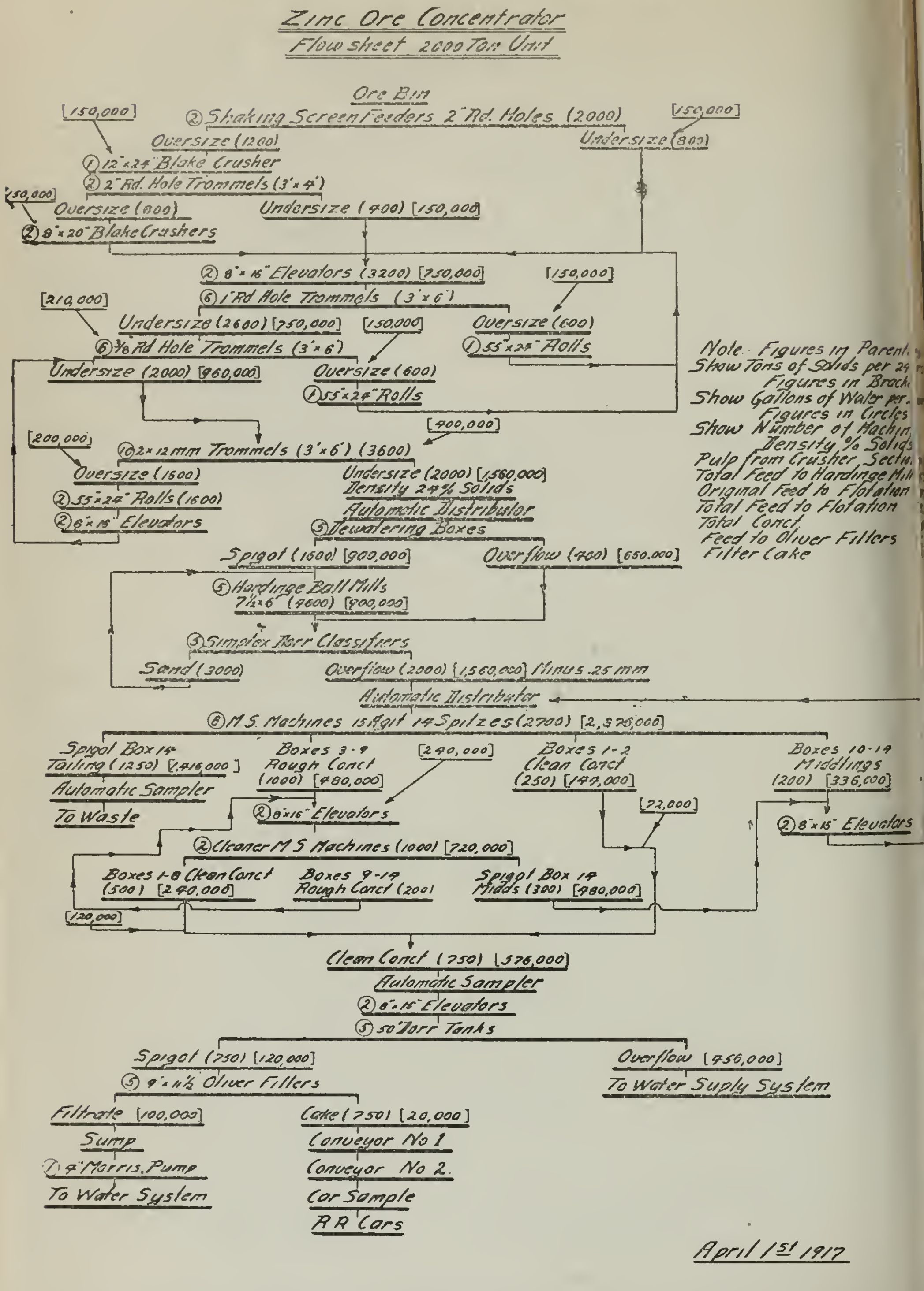
The figures in circles denote the number of machines. Those in brackets, the number of gallons of water per 24 hours, and those in parenthesis, the number of tons of solids in 24 hours.

The following quantities of reagents will be used. H_2SO_4 60°B, ab't. 12 lbs. per ton of solids. Crude wood creosote, ab't. 2.5 lbs. per ton of solids. Kerosene sludge acid, ab't 2.5 lbs. per ton of solids. The pulp will be heated to ab't. 60° to 70°F.

Cooling water from the roaster plant at a temperture ab't. 175°F, will be added to the slime pulp bringing the temperture of the latter up to ab't. 70° F.

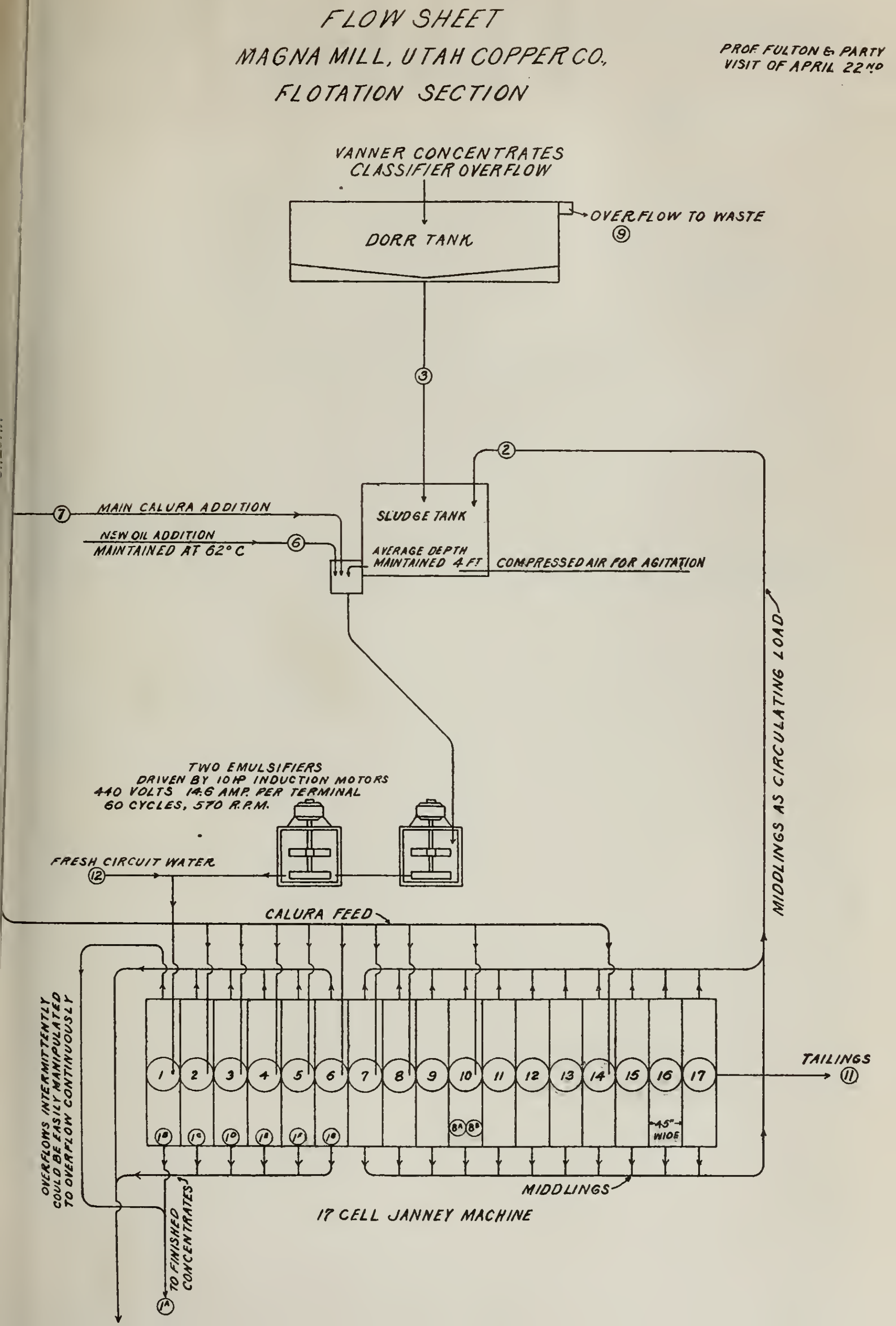
Filed May 18, 1917. GEO. W. SPROULE, Clerk. By H. H. WALKER, Deputy.

Plaintiffs' Exhibit No. 244.



Filed May 18, 1917. GEO. W. SPROULE, Clerk. By H. H. WALKER, Dep

PLAINTIFFS EXHIBIT Nº 245

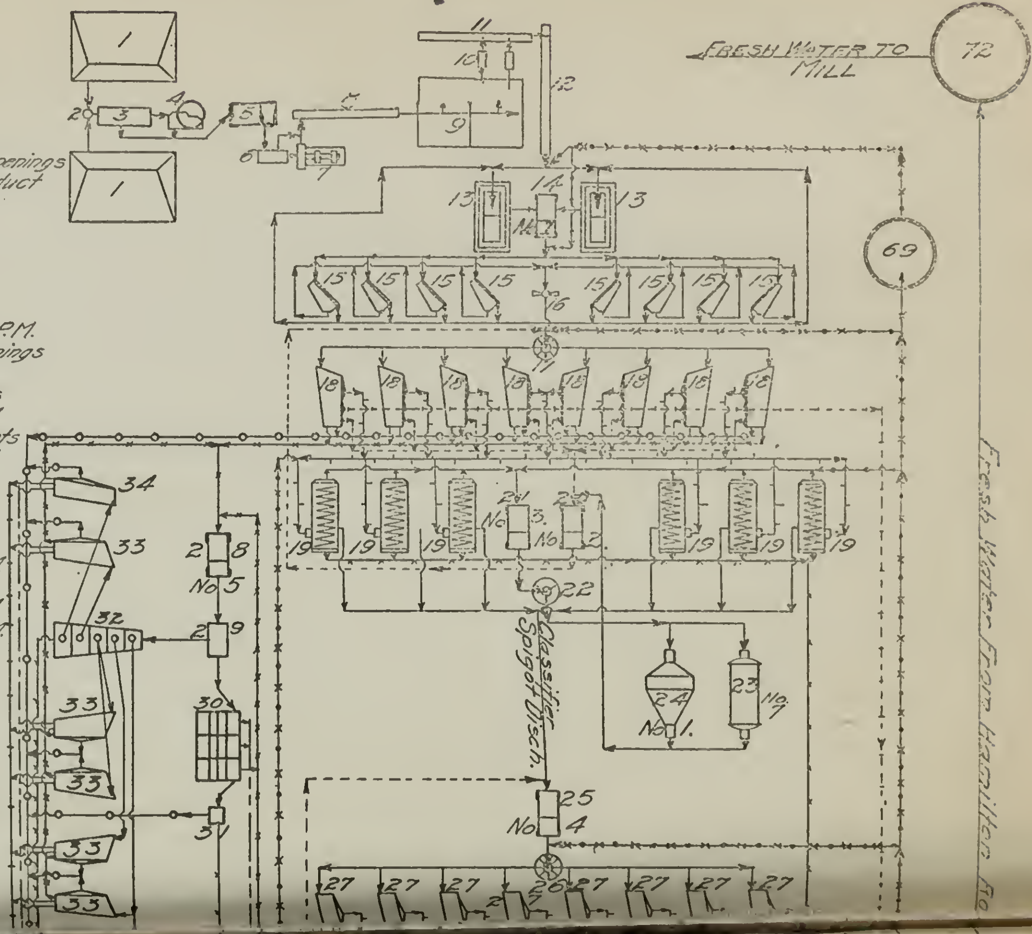


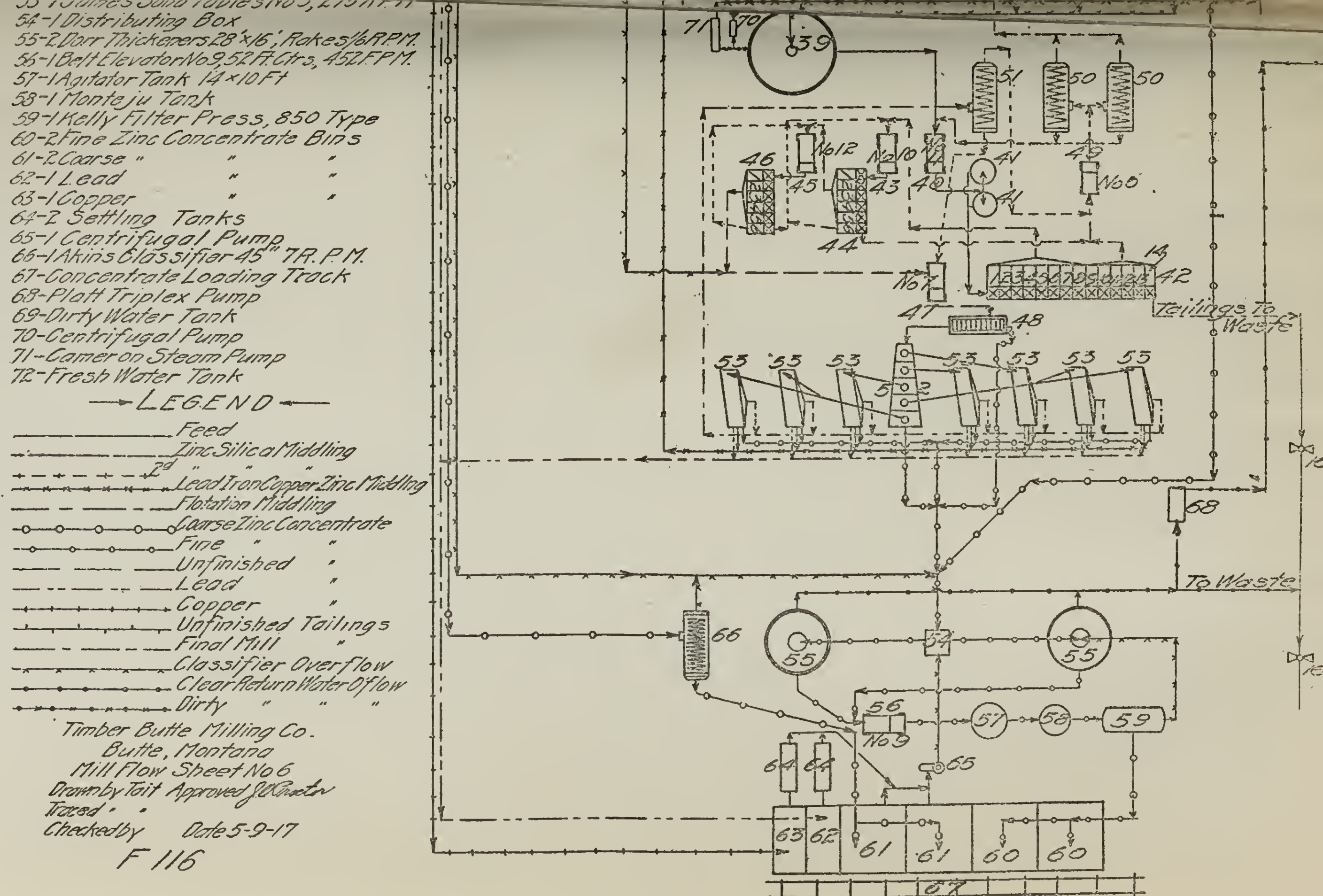
Plaintiffs' Exhibit No. 246.

FLOW SHEET TIMBER BUTTE MILL

—NOMENCLATURE—

1-Crude Ore Bin 400 Tons Capacity
2-1 Air Gate
3-1 Shaking Screen Feeder 1½" Sq. Openings
4-1 Farrell Crusher 15"x30"-3" "
5-1 Steel Elevator No. 0
6-1 Symons Pulsating Screen 3'x8'-¾" Openings
7-1 " Disc Crusher 36"-¾" Product
8-1 Belt Conveyor 24"-196 F.P.M.
9-1 Secondary Ore Bin 400 Tons
10-2 Apron Feeders 24"
11-1 Belt Conveyor 20"
12-1 " " "
13-2 Garfield Rolls 54"x18"
14-1 Belt Elevator No 1-84 Ft. Ctrs. 667 F.P.M.
15-8 Impact Screens 55 R.P.M. 2½ mm Openings
16-3 Electric Samplers
17-1 Mechanical Distributor 8 Spigots
18-8 Wilfley Roughing Tables No 6-253 R.P.M.
19-3-45" & 3-54" Akins Classifiers, 7 R.P.M. with Spigots
20-1 Belt Elevator No 2, 72 Ft. Ctrs, 604 F.P.M.
21-1 " " " 3, 50 " " ,555 "
22-1 Distributor
23-1 Tube Mill No 7 5 Ft. x 9 Ft.
24-1 Hardinge Mill 6 Ft. x 56"-24½ R.P.M.
25-1 Belt Elevator No 4-58 Ft. Ctrs. 502 F.P.M.
26-1 Distributor 8 Spigots
27-8 James Sand Tables No 3, 265 R.P.M.
28-1 Belt Elevator No 5, 60 Ft. Ctrs, 450 F.P.M.
29-1 Callow Screen, 18 mesh
30-1 Double 3 Comp't Jig
31-1 Dewatering Box
32-1 R H S Classifier, 40 Tons Capacity
33-5 Wilfley Tables No 6-255 R.P.M.
34-1 James Table No 3-262 R.P.M.
35-1 Distributing Box
36-2 Akins Classifiers 45" 7 R.P.M.
37-1 Dorr Classifier 4'6"x14'0" 25 Strokes P.M.
38-1 Hardinge Mill 8'0"x30" 24½ R.P.M.; 38A 6'0"x56"
39-1 Dorr Thickener 36x16, Rakes 1/7 R.P.M.
40-1 Belt Elevator No 11-66 Ft. Ctrs. 555 F.P.M.
41-2 Sludge Tanks 16'x10'-13½ R.P.M.
42-1 Rougher Flot. Machine. 14 Cells.





Filed May 18, 1917. GEO. W. SPROULE, Clerk. By H. H. WALKER, Deputy.

Plaintiffs' Exhibit No. 247.

TIMBER BUTTE MILLING CO
BUTTE MONT.

FLOTATION OIL CONSUMPTIONS AND ACID CONSUMPTIONS

	Flotation Oil		Flotation Acid		
	Pounds per Ton of Original Feed	Pounds per Ton of Flotation Feed	Pounds per Ton of Original Feed	Pounds per Ton of Flotation Feed	Oils Used Timber Butte Milling Co's Numbers
U-1914	.54	.60	9.77	10.84	No- 6, 140.
TEMBER '14	.49	.54	9.18	10.15	No- 6, 10, 140.
BER-1914	.51	.56	9.03	9.99	No- 6, 10, 140
ER 1914	.68	.78	9.41	10.73	No- 6, 10.
ER 1914	.76	.82	8.61	9.29	No- 6, 10.
NTHS - 1914	.61	.66	9.38	10.17	
Y-1915	.81	.87	7.70	8.36	No- 6, 10.
ARY-1915	.69	.73	5.56	5.89	No- 6, 10, 12, 50, 90.
- 1915	.71	.75	5.11	5.43	No- 6, 10, 12, 52, 88, 90, 160.
-1915	.85	.94	6.45	7.13	No- 6, 10.
1915	.85	.93	8.17	8.87	No- 6, 10, 87.
- 1915	.65	.70	8.69	9.38	No- 10, 87
- 1915	.84	.90	17.06	18.22	No- 6, 10, 87, 89, 171, 174.
ST-1915	.83	.90	12.91	13.86	No- 10, 89, 174, 192.
EMBER 1915	1.40	1.49	15.94	17.03	No- 10, 156, 174, 191, 192.
BER-1915	1.66	1.82	8.82	9.66	No- 170, 174, 191, 192
MBER-1915	1.10	1.19	8.16	8.79	No- 6, 21, 23, 87, 110, 174, 192.
EMBER 1915	1.34	1.46	9.67	10.53	No- 6, 21, 23, 87, 110, 192.
AR-1915	.97	1.05	9.22	9.94	
ARY-1916	1.27	1.36	13.74	14.70	No- 23, 87, 24, 174.
RUARY-1916	.54	.58	12.20	13.09	No- 23, 170A.
CH 1916	.46	.49	9.77	10.37	No- 170A, 192.
IL- 1916	.56	.59	10.93	11.57	No- 170A, 192
- 1916	.56	.59	10.51	11.11	No- 170A, 191. 192.
E - 1916	.51	.55	7.72	8.18	No- 87A, 170A, 191, 192.
Y- 1916	.66	.70	8.83	9.21	No- 170A, 191, 192, 270.
UST -1916	.62	.67	7.54	8.12	No- 87A, 170A, 192
TEMBER 1916	.73	.78	7.83	8.37	No- 87A, 23.
OBER-1916	.68	.73	7.31	7.81	No- 87A, 171.
EMBER 1916	.72	.79	8.43	9.23	No- 87A, 171
EMBER 1916	.59	.64	9.03	9.78	No- 87A, 171
AR- 1916	.65	.70	9.53	10.19	
NUARY 1917	.67	.73	9.40	10.36	No. 87A, 171.
BRUARY 1917	.97	1.06	8.19	8.93	No- 87A, 171 176, 292.
ARCH 1917	.81	.89	11.04	12.15	No- 170A, 171, 87A.
MONTHS EAR-1917	.80	.88	9.66	10.61	

Filed May 18, 1917. GEO. W. SPROULE, Clerk. By H. H. WALKER, Deputy.

Plaintiffs' Exhibit No. 248.

May 5, 1917.

FLOTATION OILS

of

TIMBER BUTTE MILLING CO.

	Producer.	Kind of Oil
T.B. No. 6	Georgia Pine Turpentine Co.	Crude Turpentine L.O.3
T.B. No. 10	United Naval Stores Co.	Pine Oil, M.S. No. 18
T.B. No. 12	Minerals Separation.	No. 20 Pine Oil
T.B. No. 21	Georgia Pine Turpentine Co.	Carolina Oil of Tar
T.B. No. 23	Georgia Pine Turpentine Co.	Fayetteville Wood Creosote
T.B. No. 24	Georgia Pine Turpentine Co.	Carol'na Oil of Tar, Special
T.B. No. 50	United Naval Stores Co.	Pine Oil
T.B. No. 52	United Naval Stores Co.	Turpentine "C"
T.B. No. 80	Pensacola Tar & Turpentine Co.	No. 200 Wood Creosote or C P Pine Tar
T.B. No. 85	Pensacola Tar & Turpentine Co.	No. 1000-Crude Wood Oil
T.B. No. 87	Pensacola Tar & Turpentine Co.	No. 75 Crude Turpentine
T.B. No. 87 -A	Pensacola Tar & Turpentine Co.	No. 80 Pine Oil, Crude
T.B. No. 88	Pensacola Tar & Turpentine Co.	Pine Oil D.O. Pure
T.B. No. 89	Pensacola Tar & Turpentine Co.	No. 19 Pine Oil
T.B. No. 90	Mackie Pine Products Co.	No. 3 Pine Oil
T.B. No. 110	Standard Oil Company.	Cal. Richmond Fuel Oil
T.B. No. 131	Cleveland Cliffs Co.	Refined Hardwood Creosote "XX"
T.B. No. 132	Cleveland Cliffs Co.	Refined Hardwood Creosote No. 2
T.B. No. 140	C. T. Perry & Co.	Oleic Acid
T.B. No. 156	Barrett Mfg. Co.	No. 4 Coal Tar Creosote
T.B. No. 157	Barrett Mfg. Co.	Coal Tar Creosote
T.B. No. 160	Newport Turpentine & Rosin Co.	Pure S.D. Pine Oil
T.B. No. 170	General Naval Stores Co.	No. 9 Pine Tar Oil
T.B. No. 170-A	General Naval Stores Co.	No. 1214 Pine Oil
T.B. No. 171	General Naval Stores Co.	No. 5 Pure S.D. Pine Oil
T.B. No. 174	General Naval Stores Co.	No. 8 Pine Tar Oil
T.B. No. 174-A	General Naval Stores Co.	No. 814 Pine Tar Oil
T.B. No. 176	General Naval Stores Co.	No. 17 Oil, Hard Wood Creosote
T.B. No. 191	Chesapeake Oil Co.	No. 2 Pine Oil
T.B. No. 192	Chesapeake Oil Co.	No. 3 Flotation Oil—Pine Oil
T.B. No. 270	Union Oil Company.	Kerosene Acid Sludge
T.B. No. 292	C. G. Betts Company.	Refined Coal Tar

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy

TIMBER BUTTE MILLING CO.

BUTTE, MONTANA.

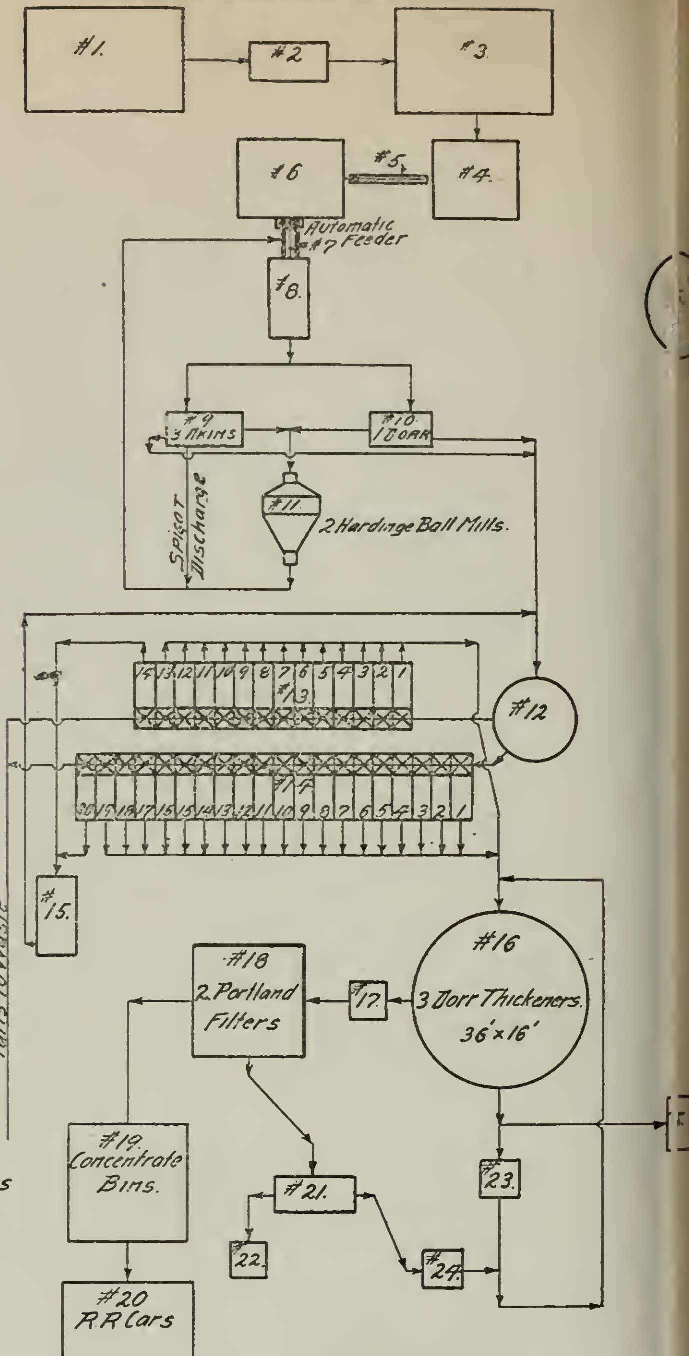
Comparison of Yearly Metallurgical Results.

Figures Based on Mill Weights and Assays.

	Origional Mill Feed		Gravity Concentrates			Flotation Feed		Flotation Conc.		Total Mill Tailings		Recovery of Zinc in Origional Mill Feed				Estimated Recovery of Zn. in Flot. Fd.	
Date	Tons	Assay % Zinc	Zinc Conc. Tons	Copper Iron Conc. Tons	Lead Conc. Tons	Tons	Assay % Zinc	Tons	Assay % Zinc	Tons	Assay % Zinc	% Zinc Recovered in fine & coarse zinc conc. by weights and assays of feed and concs.	% Zinc recovered in fine & coarse zinc concs. by tailing and concs.	% Zinc recovered in all concs. by weights and assays of feed and concs.	% Zinc recovered in all conc's. by tailing and concentrates	% Zinc recovered in flot. concs. by flotation feed and concs.	% Zinc recovered in flot. concs. by tailing and flot. concs.
Year 1915	160461.4425	16.723	16694.4235	1389.8500	340.3300	148036.6390	14.877	38406.3330	51.559	109550.5002	1.076	94.52	94.46	95.71	95.65	94.63	94.56
Year 1916	201455.0305	13.385	12118.8405	975.7205	681.7100	187677.7595	11.232	39140.1826	50.590	148537.5770	.768	94.17	94.65	95.20	95.75	93.94	94.55
Jan. Feb. Mar. 1917	41956.1680	17.426	3517.4860	287.1260	158.7295	37992.8265	14.295	9742.6090	54.474	28250.2265	.714	97.17	96.15	98.31	97.27	97.72	96.34
Years 1915-1916 Jan. Feb. Mar. 1917	403872.6410	15.131	26331.7500	2652.6965	1180.7695	373707.4250	12.829	88369.1215	51.362	285338.3035	.880	94.68	94.75	95.82	95.89	94.67	94.76

Filed May 18, 1917. GEO. W. SPROULE, Clerk. By H. H. WALKER, Deputy.

Plaintiffs' Exhibit No. 250.



1. Colusa Parrot Cop. Tailings.
2. Electric Crane
3. R. R. Cars
4. Receiving Bin
5. Conveyor Belts
6. Storage Bin
7. Launder
8. #1½ Elevator
9. 3–54" Akins Cl'sf's.
10. 1– " Dorr "
11. 2 Hd'g'e Ball Mills
12. Sludge Tank.
13. 14 Cell Flot.n Mch.n
14. 20 " " "
15. #8 Elevator
16. 3 Dorr Thickeners
17. 2 Diaphragm Pumps
18. 2 Portland Filters
19. Concentrate Bins
20. R. R Cars
21. Vacuum Receiver
22. " Pump
23. Centrif. "
24. 2" Centrif. "
25. Worthington ..
26. Tank at head of Mill

Filed May 18, 1917.
GEO. W. SPROULE,
Clerk.
By H. H. WALKER,
Deputy.

TIMBER BUTTE MILLING COMPANY

BUTTE–MONTANA.

TESTING DEPARTMENT.

FLOW SHEET NO 2. COPPER SECTION EFFECTIVE A[illegible]

DRAWN BY J FRED SMITH APPROVED BY [illegible]

Defendant's Exhibit No. 251.

UTAH COPPER COMPANY

ARTHUR PLANT

EXPERIMENTAL AND RESEARCH DEPARTMENT

Determinations on Magna Flotation Products for Butte & Sup. Litigation Sample No. 3—Feed From Dorr Thickener

Weight of sample submitted to laboratory (H20 plus solids) Gms.	1966.00
Weight of wash water, Gms	265.00
Weight of original feed (H20 plus solids), Gms	1701.00
Weight of water in original feed sample, Gms	919.00
Weight of solids in original feed sample, Gms	782.0
Per cent solids in original feed sample	45.97
Per cent water in original feed sample	54.03
Pounds feed delivered per second (H20 plus solids)	28.857
Pounds feed delivered per 24 hours	2,493,244.800
Pounds solids delivered per 24 hours	1,146,144.630
Tons solids delivered per 24 hours	573.072
Tons water delivered per 24 hours	673.550

ASSAY ANALYSIS

Per cent total copper	7.175
Per cent sulphide copper	7.095
Per cent iron	8.30
Per cent insoluble	69.00

OIL ANALYSIS

Total weight of sample (Gms.)	782.0
Total weight of oil content (Gms.)	.1270
Pounds oil per ton	.32

Page 4

NO. 2 SAMPLE (CIRCULATING PULP)

Weight of material in bottle (H20 plus solids) Gms	2279.5
Weight of wash water	390.0
Weight of original sample (H20 plus solids)	1889.5
Weight of original sample (Solids)	408.7
Weight of original sample (Water)	1480.8
Per cent solids in circulating pulp	21.63
Pounds pulp circulating per 24 hours	1,061,078.40
Pounds solids circulating per 24 hours	229,511.26
Tons solids circulating per 24 hours	114.756
Tons H20 circulating per 24 hours	388.298

ASSAY ANALYSIS

Per cent total copper	16.700
Per cent sulphide copper	16.435
Per cent iron	21.50
Per cent insoluble	27.50

OIL ANALYSIS

Total weight of sample (Gms.)	408.7
Total weight of oil content (Gms.)	7.7375
Pounds oil per ton	37.86

Defendant's Exhibit No. 251

UTAH COPPER COMPANY

ARTHUR PLANT

EXPERIMENTAL AND RESEARCH DEPARTMENT

Determinations on Magna Flotation Products for Butte & Superior Litigation

NO. 6 OIL SAMPLE

(General)

Net weight oil delivered in 30 seconds (sample), Gms.	1926.000
Lbs.	4.243
Pounds oil delivered per 24 hours	12,220.416
Pounds oil per ton ore treated	21.324

UTAH COPPER COMPANY

ARTHUR PLANT

EXPERIMENTAL AND RESEARCH DEPARTMENT

Magna Sample No. 1-B—Machine No. 1, Spitz No. 1 Overflow

ASSAY ANALYSIS

Per cent total copper	19.100
Per cent sulphide copper	18.980
Per cent iron	19.40
Per cent insoluble	27.30

OIL ANALYSIS

Total weight of sample (Gms.)	305.9065
Total weight of oil content (Gms.)	63.0640
Pounds oil per ton	412.31

A part of this sample was lost in handling in the physical laboratory.

UTAH COPPER COMPANY

ARTHUR PLANT

METALLURGICAL AND RESEARCH DEPARTMENT

Magna Sample No. 1C, Machine No. 1 Spitz No. 2 Overflow

ASSAY ANALYSIS

Per cent total copper	21.250
Per cent sulphide copper	21.200
Per cent iron	27.15
Per cent insoluble	12.20

OIL ANALYSIS

Total weight of sample (Gms.)	544.2500
Total weight of oil content (Gms)	26.3290
Pounds oil per ton	96.75

Defendant's Exhibit No. 251

UTAH COPPER COMPANY

ARTHUR PLANT

EXPERIMENTAL AND RESEARCH DEPARTMENT

Magna Sample No. 1-D—Machine No. 1, Spitz No. 3—Overflow

ASSAY ANALYSIS

Per cent total copper	22.200
Per cent sulphide copper	22.180
Per cent iron	27.20
Per cent insoluble	11.00

OIL ANALYSIS

Total weight of sample (Gms.)	696.8000
Total weight of oil content (Gms.)	19.4140
Pounds oil per ton	55.72

UTAH COPPER COMPANY

ARTHUR PLANT

EXPERIMENTAL AND RESEARCH DEPARTMENT

Magna Sample No. 1-E, Machine No. 1, Spitz No. 4 Overflow

ASSAY ANALYSIS

Per cent total copper	23.000
Per cent sulphide copper	22.990
Per cent iron	26.60
Per cent insoluble	10.00

OIL ANALYSIS

Total weight of sample (Gms.)	875.55
Total weight of oil content	12.5720
Pounds oil per ton	28.72

UTAH COPPER COMPANY

ARTHUR PLANT

METALLURGICAL AND RESEARCH DEPARTMENT

Magna Sample No. 1-F—Machine No. 1, Spitz No. 5 Overflow

ASSAY ANALYSIS

Per cent total copper	23.900
Per cent sulphide copper	23.830
Per cent iron	26.90
Per cent insoluble	9.30

OIL ANALYSIS

Total weight of sample (Gms.)	590.9970
Total weight of oil content (Gms.)	4.8438
Pounds oil per ton	16.39

The oil result obtained on this sample is doubtless low on account of an explosion that took place while making the oil determination which caused some loss of sample.

Defendant's Exhibit No. 251

UTAH COPPER COMPANY

ARTHUR PLANT

METALLURGICAL AND RESEARCH DEPARTMENT

Magna Sample No. 1-G—Machine No. 1—Spitz No. 6 Overflow

ASSAY ANALYSIS

Per cent total copper	23.800
Per cent sulphide copper	23.790
Per cent iron	26.20
Per cent insoluble	11.00

OIL ANALYSIS

Total weight of sample (Gms.)	397.2760
Total weight of oil content (Gms.)	5.2463
Pounds oil per ton	26.41

UTAH COPPER COMPANY

ARTHUR PLANT

METALLURGICAL AND RESEARCH DEPARTMENT

Magna Sample No. 8-B, Machine No. 1—Spitz No. 10—Dark Color Oily Concentrate

ASSAY ANALYSIS

Per cent total copper	18.800
Per cent sulphide copper	18.480
Per cent iron	16.30
Per cent insoluble	32.10

OIL ANALYSIS

Total weight of sample (Gms.)	28.9530
Total weight of oil content (Gms.)	2.6630
Pounds oil per ton	183.95

UTAH COPPER COMPANY

ARTHUR PLANT

METALLURGICAL AND RESEARCH DEPARTMENT

Magna Sample No. 8-A—Machine No. 1—Spitz No. 10—Light Color Froth

ASSAY ANALYSIS

Per cent total copper	12.250
Per cent sulphide copper	11.970
Per cent iron	11.40
Per cent insoluble	49.70

OIL ANALYSIS

Total weight of sample (Gms.)	19.3450
Total weight of oil content (Gms.)	.6570
Pounds oil per ton	67.94

Defendant's Exhibit No. 251

UTAH COPPER COMPANY

ARTHUR PLANT

METALLURGICAL AND RESEARCH DEPARTMENT

Magna Sample No. 1-A—Machine No. 1 Combined Concentrate

ASSAY ANALYSIS

Per cent total copper	25.650
Per cent sulphide copper	25.570
Per cent iron	22.40
Per cent insoluble	15.40

OIL ANALYSIS

Total weight of sample (Gms.)	493.9315
Total weight of oil content (Gms.)	11.5778
Pounds oil per ton	46.88

NO. 11 TAILING SAMPLE (CUT NO. 1)

Weight of material in bottle (original sample and wash H_2O) Gms.	2893.0
Weight of wash water, Gms.	130.0
Weight of original sample, Gms.	2763.0
Weight of H_2O decanted, Gms.	1979.0
Weight of residual pulp, Gms.	914.0
Weight of solids in residual pulp, Gms.	681.5
Weight of H_2O in residual pulp, Gms.	232.5
Total weight of H_2O in original sample	2081.5
Per cent solids in original sample	24.67

ASSAY ANALYSIS

Per cent total copper	.165
Per cent sulphide copper	.140
Per cent iron	1.85
Per cent insoluble	90.80

OIL ANALYSIS

Total weight of sample (Gms.)	681.50
Total weight of oil content (Gms.)	2.2480
Pounds oil per ton	6.60

NO. 11 TAILING SAMPLE (CUT NO. 2)

Weight of material in bottle (original sample and wash H_2O), Gms.	2841.6
Weight of wash water, Gms.	100.0
Weight of original sample	2741.6
Weight of H_2O decanted, Gms.	1937.0
Weight of residual pulp, Gms.	914.6
Weight of solids in residual pulp, Gms.	673.0
Weight of H_2O in residual pulp, Gms.	241.6
Total weight of H_2O in original sample, Gms.	2078.6
Per cent solids in original sample	24.55

ASSAY ANALYSIS

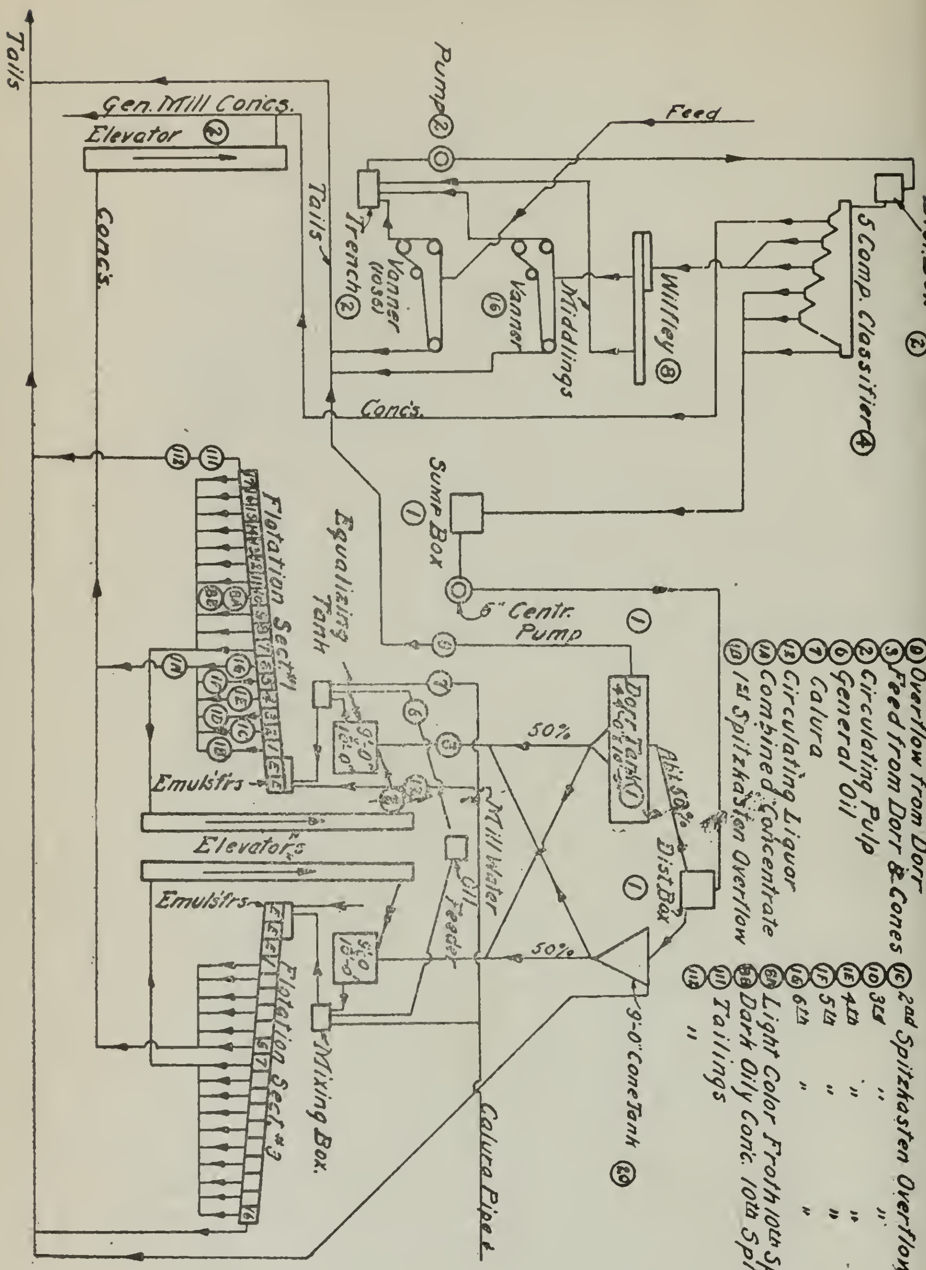
Per cent total copper	.155
Per cent sulphide copper	.130
Per cent iron	1.80
Per cent insoluble	88.00

OIL ANALYSIS

Total weight of sample (Gms.)	673.0
Total weight of oil content (Gms.)	1.9345
Pounds oil per ton	5.75

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Defendant's Exhibit No. 251.



Flow Sheet For Flotation Plant
and as operating on April 21-17.

Utah Copper Co- Magna Plant.

Plainti

BUTT
VISIT OF MINERALS
TEST

PRODUCT	DRY WEIGHT		ZIN
	Total in 4 hr. Tons.	Per cent of Heads	Assay %
Concentrates Sharps	31.37	11.9	46.9
Concentrates Slimes	28.79	10.9	41.8
Concentrates Total	60.16	22.8	44.5
Concentrates from B. & S. figures	(60.16)		(45.2)
Tailings Sharps	111.40	42.3	1.49
Tailings Slimes	91.97	34.9	1.91
Tailings Total	203.37	77.2	1.68
Tailings from B. & S. figures			(1.57)
Heads Calc' (Conc. plus Tails)	263.53	100.00	11.44
from B. & S. figures	(263.53)		(11.53)

. 252.

MILL
TY APRIL 29TH, 1917
P. M.

L OILS RECOVERED		VOLATILE OILS RECOVERED		NON-VOLATILE OILS RECOVERED	
Lbs. per ton of Product	Per cent of total Oil Feed in 4 hours	Lbs. per Ton of Product	Per cent of total Volatile Oil recovered in Concts. and Tails	Lbs. per Ton of Product	Per cent of Total Non-Volatile Oil Recovered
22.8	10.5	10.6	12.29	12.2	10.80
93.4	39.5	49.2	52.34	44.2	35.89
56.6	50.0	29.1	64.63	27.5	46.69
(62.6)	(54.2)				
0.296	0.5	0.172	0.71	0.124	0.39
30.6	41.3	10.2	34.66	20.4	52.92
14.00	41.7	4.7	35.37	9.3	53.31
(13.4)	(39.2)				
23.7	91.7	10.3	100.0	13.4	100.0
(24.63)	(93.4)				

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Plaintiffs' Exhibit No. 253.

UTAH COPPER SAMPLES

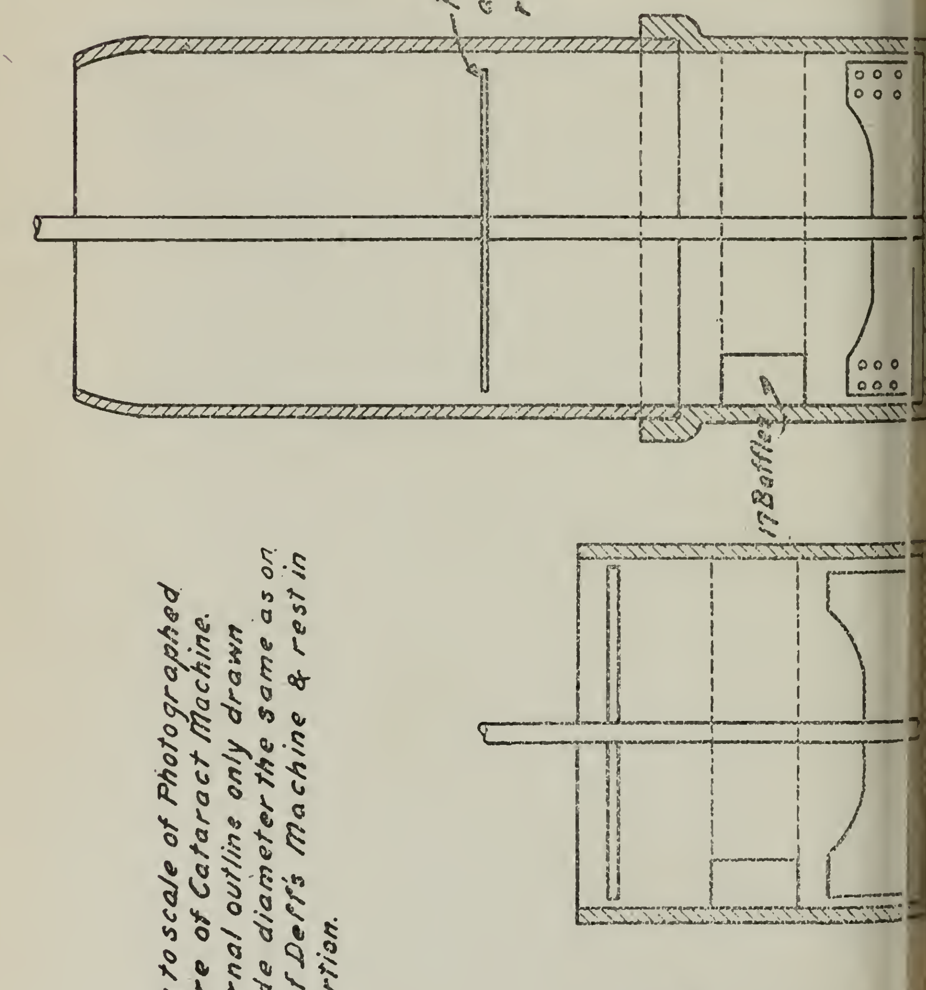
% Copper		Weights of Products Calculated From Assays Ton Unit	Indicated Copper Recovery	Oil % upon Products	Recovery of oil fed 1.06% or 21.15 lbs. per ton
Heads	7.4	2000 lb.			
Concentrates	26.3	550 lb.	97.9%	Vol .67% Non V. 2.14 Total 2.81	73.1%
Tailings	.2	1450 lb.		Vol. .039% Non V. .160	13.6%
				Total	.199
Total					86.7%
Skimmings 1st. Spitzkasten	19.7			Total oil 26.24%	
Concentrates from 2nd Spitzkasten	21.75			Total oil 4.87%	

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Cataract Machine

May 3, 1917

Scale 6 = 1 Ft.



Copy to scale of Photographed picture of Cataract Machine.
Internal outline only drawn
Inside diameter the same as on Dwg. of Deff's Machine & rest in proportion.

Filed May 18. 1917.
GEO. W. SPROULE, Cl
By H. H. WALKER, Dut

MINERALS SEPA[illegible]

Referring to Defen[illegible]

Period	Heading to Flotation			Ratio of Concentration	Flotation Concentrates			Recovery % Cu.		
	Tons	Assay % Cu.	Contents Lbs. Cu.		Tons	Assay % Cu.	Contents Lbs. of Cu.	Calculated By Contents	Given in Exh. 29	To[illegible] By [illegible] fere[illegible]
1916 3rd Quarter....	26804	7.01	3757921	3.94	6804	27.10	3687768	98.13	96.717	2 0[illegible]
1916 October..........	9794	7.77	1521988	3.40	2884	26.03	1501410	98.65	98.17	[illegible]
1916 Nov. 18, 19. 20	561	10.24	114693	2.95	190	29.28	111254	96.84	98.437	[illegible]

ai iff's Exhibit No. 255.

. LI ITED ET AL. VS. BUTTE & SUPERIOR MINING CO.

29 Chino Copper Company—Retreatment of Vanner Concentrates.

Mr. Wick's Evidence Q. 25 and Q. 26.

ling			Loss of Cu. in Tailings per ton of Heading		Cost of Smelting Concentrate			Cost of Concentration		Total Increase of cost per ton of Heading	Oil Lbs. per ton of Heading	Other Reagents Lbs. per ton of Heading
	ssay % Cu.											
e	(cu- la l By on- nts	Given in Exh. 29	Lbs.	Value if one lb. cu. in conc. be worth 20c net to the Mill	Smelting Charge & Freight per ton of Con-centrate	Total	Per ton of Head-ing to Flota-tion	Operating per ton of Heading	Cost per ton of Heading including loss in tails and Cost of Smelting			
53	.175	.306	2.62	\$ 0.524	\$ 6.00	\$ 40824	\$ 1.523	\$ a	\$ a + 0.524 + 1.523 = a + 2.047		8.76	4.57
78	.149	.200	2.10	0 420	"	17304	1.767	a	a + 0.420 + 1.767 a + 2.187		10.26	4.77
29	.489	.244	6.47	1.294	"	1140	2.032	a + 15 for (Extra Oil) &c.	a + 0.15 + 1.294 + 2.032 = a + 3.476		23.70	6.34

Filed May 18, 1917

GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

MINERALS SEPARATION LIMITED ET AL. VS. BUTTE AND SUPERIOR MINI

Referring to Defendant's Exhibit No. 150. Ray Co

Period	Heading to Flotation			Ratio of Concentration	Flotation Concentrate			Recovery	
	Tons	Assay Cu. %	Contents Lbs. Cu.		Tons	Assay Cu. %	Contents Lbs. Cu.	Calculated	% Cu. Given Exh. 150
1916 4th Quartr.	27275	6.099	3527005	4.48	6086	26.38	3210974	96.51	96.5
1917 1st Quartr...	28913	6.531	3776812	3.64	7933	22.76	3592556	95.12	95.4

NOTE.—There would also be an additional smelting loss in the second case owing to the lar

iniff's Exhibit No. 256.

er . Retreatment of Vanner Concentrates Products. Mr. Engelmann's Evidence, Q. 32-37 and Q. 84.

	ilings		Loss of Cu. in Tailings p. ton of Heading		Cost of Smelting Concentrates			Cost of Concentration			Oil lbs. per ton of Heading	Other Reagents Lbs. per ton of Heading
ent Cu iff	Assay Cu % Calculated	Given Exh. 150	Lbs.	If one lb. of copper in Concentrate be worth 20c net to the mill.	Smelting charge per ton of Concentrate	Total	Per Ton of Heading	Operating per ton of Heading	Total cost per ton of heading including loss in tails and Smelting charge	Total increase of cost per ton of Heading in 1st Q. 1917		
					$	$		$		$		
160	0.274	0.273	4.25	0.85	5.00	30430	1.12	a	a + 65 + 1.12 = a + 2.99		3.54	
342	0.439	0.413	6.37	1.27	5.00	39665	1.37	a + 0.15 (For extra oil)	a + .15 + .1.27 + 1.37 = a + 2.79	0.82	20.10	

lag nade.

Filed May 18, 1917. GEORGE W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Plaintiffs' Exhibit No. 257.

IN THE DISTRICT COURT OF THE UNITED STATES, FOR THE DISTRICT OF MONTANA.

MINERAL SEPARATION, LIMITED, Plaintiff, vs. BUTTE & SUPERIOR COPPER COMPANY, LIMITED. Defendant.	IN EQUITY

STATEMENT OF BUTTE AND SUPERIOR COPPER COMPANY, LIMITED, FOR THE MONTH OF JANUARY, 1916, FILED PURSUANT TO ORDER OF COURT ENTERED IN ABOVE ENTITLED ACTION ON NOVEMBER 15th, 1913.

Comes now Butte and Superior Copper Company, Limited, and in compliance with the order of court entered in the above entitled cause on the 15th day of November, 1913, files the following statement showing an approximate estimate for the month of January, 1916.

Plaintiffs' Exhibit No. 257

1. Of the amount of ore treated in its oil flotation plant.............................49428.060 Tons

2. Of the amount of concentrates recovered in its oil flotation plant..10535.210 "

3. Of the analysis and assay returns of heads in its oil flotation plant

12.4956%	Zn.
.7744%	Pb.
.238%	Cu.
1.3536%	Fe.
1.4154%	Mn.
73.1557%	Insol.
5.3859	Oz. Ag.
.0112	" Au

4. Of the analysis and assay returns of concentrates recovered in its oil flotation plant........................

54.593%	Zn.
2.991%	Pb.
.620%	Cu.
2.137%	Fe.
.249%	Mn.
8.580%	Insol.
23.057	Oz. Ag.
.0330	Oz. Au.

5. Of the cost of flotation per ton of concentrates recovered in its oil flotation plant ....$ 3.0583

6. Of the value per ton of concentrates recovered in its oil flotation plant............$101.164

Plaintiffs' Exhibit No. 257

The figures set forth under the foregoing six paragraphs are, as noted, approximate estimates, for the reason that at the date of the filing of this statement no exact information has been acquired by the Butte and Superior Copper Company, Limited, so that accurate figures can be given.

7. As to the analysis and assay returns of tails from the oil flotation plant, the following figures are accurate and not estimates...

1.2008	%	Zn.
.0500	%	Pb.
.065	%	Cu.
.8300	%	Fe.
1.5500	%	Mn.
90.48	%	Insol.
1.0600	Oz.	Ag.
.00208	"	Au.

Plaintiffs' Exhibit No. 257

UNITED STATES OF AMERICA,
DISTRICT OF MONTANA,—ss.

CHAS. BOCKING, being first duly sworn on oath, deposes and says:

That he is the Cashier of the Butte and Superior Copper Company, Limited, and makes this affidavit for and on its behalf; that he has read the foregoing statement and knows the contents thereof; that the approximate estimates therein set forth are true to the best of his knowledge, information and belief; that such approximate estimates in said report are set forth under paragraphs 1 to 6 inclusive; that as to the analysis and assay returns of this from the oil flotation plant under paragraph 7 of said statement, the same is not an approximate estimate, but that the percentages and weights contained in the answer thereto are accurate, to the best of his knowledge, information and belief.

CHAS. BOCKING

February, 1916.

Subscribed and sworn to before me this 19th day of February, 1916.

C. K. TUOHY,

Notary Public for the State of Montana, residing at Butte, Montana.

My commission expires July 7, 1918.

(SEAL.)

Filed May 18, 1917.

GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Plaintiff's Exhibit No. 258.

IN THE DISTRICT COURT OF THE UNITED STATES, FOR THE DISTRICT OF MONTANA.

MINERAL SEPARATION, LIMITED, Plaintiff, vs. BUTTE & SUPERIOR COPPER COMPANY, LIMITED, Defendant.	IN EQUITY

STATEMENT OF BUTTE AND SUPERIOR COPPER COMPANY, LIMITED, FOR THE MONTH OF FEBRUARY, 1916, FILED PURSUANT TO ORDER OF COURT ENTERED IN THE ABOVE ENTITLED ACTION ON NOVEMBER 15th, 191~~6~~3.

Comes now Butte and Superior Copper Company, Limited, and in compliance with the order of court entered in the above entitled cause on the 15th day of November, 1913, files the following statement showing an approximate estimate for the month of February, 1916.

Plaintiffs' Exhibit No. 258

1. Of the amount of ore treated in its oil flotation plant................ 49,800.276 Tons

2. Of the amount of concentrates recovered in its oil flotation plant .... 10,774.997 "

3. Of the analysis and assay returns of heads in its oil flotation plant ....11.8580% Zn.

.7534%	Pb.
.1645%	Cu.
1.3998%	Fe.
1.2018%	Mn.
71.6222%	Insol.
5.7921	Oz. Ag.
.00956	Oz. Au.

5. Of the cost of flotation per ton of concentrates recovered in its oil flotation plant..$2.5271
6. Of the value per ton of concentrates recovered in its oil flotation plant................$93.567

The figures set forth under the foregoing six paragraphs are, as noted, approximate estimates, for the reason that at the date of the filing of this statement no exact information has been acquired by the Butte and Superior Copper Company, Limited, so that accurate figures can be given.

ons

P. 5380, After line 16 insert: " 4. Of the analysis and assay returns of concentrates recovered in its oil flotation plant

53.940%	Zn.
2.956%	Pb.
.627%	Cu.
2.069%	Fe.
.273%	Mn.
9.293%	Insol.
23.016	Oz. Ag.
.0338	Oz. Au.

para-
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ment
Butte
ccur-

Plaintiffs' Exhibit No. 258

7. As to the analysis and assay returns of tails from the oil flotation plant, the following figures are accurate and not estimates	1.5034% Zn.
	.0800% Pb.
	.0450% Cu.
	.8500% Fe.
	1.500 % Mn.
	90.59 % Insol.
	1.0100 Oz. Ag.
	.00209 Oz. Au.

Plaintiffs' Exhibit No. 258

UNITED STATES OF AMERICA,
DISTRICT OF MONTANA—ss.

CHAS. BOCKING, being first duly sworn on oath, deposes and says:

That he is the Cashier of the Butte and Superior Copper Company, Limited, and makes this affidavit for and on its behalf; that he has read the foregoing statement and knows the contents thereof; that the approximate estimates therein set forth are true to the best of his knowledge, information and belief; that such approximate estimates in said report are set forth under paragraphs 1 to 6, inclusive; that as to the analysis and assay returns of this from the oil flotation plant under paragraph 7 of said statement, the same is not an approximate estimate, but that the percentages and weights contained in the answer thereto are accurate, to the best of his knowledge, information and belief.

CHAS. BOCKING.

Subscribed and sworn to before me this 20th day of February, 1916.

ALF. C. KREMER,

Notary public for the State of Montana, residing at Butte, Montana.

My commission expires Sept. 5, 1916.

Filed May 18, 1917.

GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Plaintiffs' Exhibit No. 259.

IN THE DISTRICT COURT OF THE UNITED STATES, FOR THE DISTRICT OF MONTANA.

MINERAL SEPARATION, LIMITED, Plaintiff, vs. BUTTE & SUPERIOR COPPER COMPANY, LIMITED, Defendant.	IN EQUITY.

STATEMENT OF BUTTE AND SUPERIOR COPPER COMPANY, LIMITED, FOR THE MONTH OF MARCH, 1916, FILED PURSUANT TO ORDER OF COURT ENTERED IN THE ABOVE ENTITLED ACTION ON NOVEMBER 15TH, 1913.

Comes now Butte and Superior Copper Company, Limited, and in compliance with the order of court entered in the above entitled cause on the 15th day of November, 1913, files the following statement showing an approximate estimate for the month of March, 1916.

Plaintiffs' Exhibit No. 259

1. Of the amount of ore treated in its oil flotation plant	52,089.4335	Tons
2. Of the amount of concentrates recovered in its oil flotation plant	12,199.0195	"
3. Of the analysis and assay returns of heads in its oil flotation plant	13.7634%	Zn.
	.7238%	Pb.
	.1572%	Cu.
	1.2916%	Fe.
	1.2720%	Mn.
	71.7590%	Insol.
	5.8663	Oz. Ag.
	.0089	Oz. Au.
4. Of the analysis and assay returns of concentrates recovered in its oil flotation	53.752%	Zn.
	3.046%	Pb.
	.598%	Cu.
	1.971%	Fe.
	.295%	Mn.
	10.107%	Insol.
	23.388	Oz. Ag.
	.0347	Oz. Au.
5. Of the cost of flotation per ton of concentrates recovered in its oil flotation plant	$ 2.6968	
6. Of the value per ton of concentrates recovered in its oil flotation plant	$93.627	

P. 5385, L. 16, Insert "90.4000% Insol."

Plaintiffs' Exhibit No. 259

The figures set forth under the foregoing six paragraphs are as noted, approximate estimates, for the reason that at the date of the filing of this statement no exact information has been acquired by the Butte and Superior Copper Company, Limited, so that accurate figures can be given.

7. As to the analysis and assay returns of tails from the oil flotation plant, the following figures are accurate and not estimates	1.3138%	Zn.
	.0600%	Pb.
	.0330%	Cu.
	.8400%	Fe.
	1.5300%	Mn.
	.9700	Oz. Ag.
	.0025	Oz. Au.

Plaintiffs' Exhibit No. 259

UNITED STATES OF AMERICA,
DISTRICT OF MONTANA—ss.

CHAS. BOCKING, being first duly sworn on oath, deposes and says:

That he is the cashier of the Butte and Superior Copper Company, Limited, and makes this affidavit for and on its behalf; that he has read the foregoing statement and knows the contents thereof; that the approximate estimates therein set forth are true to the best of his knowledge, information and belief; that such approximate estimates in said report are set forth under paragraphs 1 to 6 inclusive; that as to the analysis and assay returns of this from the oil flotation plant under paragraph 7 of said statement, the same is not an approximate estimate, but that the percentages of weights contained in the answer thereto are accurate, to the best of his knowledge, information and belief.

CHAS. BOCKING.

Subscribed and sworn to before me this 20th day of April, 1916.

ALF C. KREMER,

Notary Public for the State of Montana, residing at Butte, Montana.

My commisison expires Sept. 5, 1916.

Filed May 18, 1917.

GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Plaintiffs' Exhibit No. 260.

IN THE DISTRICT COURT OF THE UNITED STATES, FOR THE DISTRICT OF MONTANA.

MINERAL SEPARATION, LIMITED, Plaintiff, vs. BUTTE & SUPERIOR COPPER COMPANY, LIMITED, Defendant.	IN EQUITY.

STATEMENT OF BUTTE AND SUPERIOR COPPER COMPANY, LIMITED, FOR THE MONTH OF APRIL, 1916, FILED PURSUANT TO ORDER OF COURT ENTERED IN ABOVE ENTITLED CAUSE ON NOVEMBER 15TH, 1913.

Comes now Butte and Superior Copper Company, Limited, and in compliance with the order of court entered in the above entitled cause on the 15th day of November, 1913, files the following statement showing an approximate estimate for the month of April, 1916:

Plaintiffs' Exhibit No. 260

1. Of the amount of ore treated in its oil flotation plant ....50,115.6675 Tons
2. Of the amount of concentrates recovered in its oil flotation plant.12,080.5145 tons
3. Of the analysis and assay returns of heads in its oil flotation plant ....14.0828% Zn.
   .8599% Pb.
   .1936% Cu.
   1.2723% Fe.
   1.3087% Mn.
   71.5644% Insol.
   6.2552 Oz. Ag.
   .0107 Oz. Au.
4. Of the analysis and assay returns of concentrates recovered in its oil flotation plant....................53.353% Zn.
   3.311% Pb.
   .558% Cu.
   2.043% Fe.
   .352% Mn.
   10.355% Insol.
   23.713 Oz. Ag.
   .0347 Oz. Au.
5. Of the cost of flotation per ton of concentrates recovered in its oil flotation plant .... $ 2.8430
6. Of the value per ton of concentrates recovered in its oil flotation plant.............. 83.7990

The figures set forth under the foregoing six para-

Plaintiffs' Exhibit No. 260

graphs are as noted, approximate estimates, for the reason that at the date of the filing of this statement no exact information has been acquired by the Butte and Superior Copper Company, Limited, so that accurate figures can be given.

7. As to the analysis and assay returns of tails from the oil flotation plant the following figures are accurate and not estimates..1.3810% Zn.

1.3810%	Zn.
.0800%	Pb.
.0400%	Cu.
.7500%	Fe.
1.4500%	Mn.
91.1000%	Insol.
.9200	Oz. Ag.
.00208	Oz. Au.

Plaintiffs' Exhibit No. 260

UNITED STATES OF AMERICA,
DISTRICT OF MONTANA—ss.

CHAS. BOCKING, being first duly sworn on oath, deposes and says:

That he is the cashier of the Butte and Superior Copper Company Limited, and makes this affidavit for and on its behalf; that he has read the foregoing statement and knows the contents thereof; that the approximate estimates therein set forth are true to the best of his knowledge, information and belief; that such approximate estimates in said report are set forth under paragraphs 1 to 6 inclusive; that as to the analysis and assay returns of this from the oil flotation plant under paragraph 7 of said statement the same is not an approximate estimate, but that the percentages and weights contained in the answer thereto are accurate to the best of his knowledge, information and belief.

CHAS. BOCKING.

Subscribed and sworn to before me this 19th day of May, 1916.

C. K. TUOHY,

Notary Public for the State of Montana, residing at Butte, Montana.

My commission expires July 7th, 1918.

Filed May 18, 1917.

GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Plaintiffs' Exhibit No. 261.

IN THE DISTRICT COURT OF THE UNITED STATES, FOR THE DISTRICT OF MONTANA.

MINERALS SEPARATION, LIMITED, Plaintiff, vs. BUTTE & SUPERIOR COPPER COMPANY, LIMITED, Defendant.	IN EQUITY.

STATEMENT OF BUTTE AND SUPERIOR COPPER COMPANY LIMITED (NOW BUTTE AND SUPERIOR MINING COMPANY) FOR THE MONTH OF MAY, 1916, FILED PURSUANT TO ORDER OF COURT ENTERED IN THE ABOVE ENTITLED CAUSE ON NOVEMBER 15TH, 1913.

Comes now Butte and Superior Copper Company, Limited (now Butte and Superior Mining Company), and in compliance with the order of court entered in the above entitled cause on the 15th day of November,

Plaintiffs' Exhibit No. 261

1913, files the following statement showing an approximate estimate for the month of May, 1916:

1. Of the amount of ore treated in its oil flotation plant	50,688.330	Tons.
2. Of the amount of concentrates recovered in its oil flotation plant	11,658.5905	"
3. Of the analysis and assay returns of heads in its flotation plant	13.8251%	Zn.
	.8454%	Pb.
	.1798%	Cu.
	1.4238%	Fe.
	1.2746	Mn.
	72.1681%	Insol.
	5.6426	Oz. Ag.
	.0110	Oz. Au.
4. Of the analysis and assay returns of concentrates recovered in its oil flotation	54.650%	Zn.
	3.032%	Pb.
	.578%	Cu.
	2.475%	Fe.
	.256%	Mn.
	7.747%	Insol.
	22.976	Oz. Ag.
	.0337	Oz. Au.

Plaintiffs' Exhibit No. 261

5. Of the cost of flotation per ton of concentrates recovered in its oil flotation plant. $ 3.2337

6. Of the value per ton of concentrates recovered in its oil flotation plant..............$65.27

The figures set forth under the foregoing six paragraphs are, as noted, approximate estimates, for the reason that at the date of the filing of this statement no exact information has been acquired by the Butte and Superior Copper Company, Limited (now Butte and Superior Mining Company), so that accurate figures can be given.

7. As to the analysis and assay returns of tails from the oil flotation plant the following figures are accurate and not estimates

	1.3509%	Zn.
	.0600%	Pb.
	.0500%	Cu.
	.7800%	Fe.
	1.5500%	Mn.
	90.1400%	Insol.
	.8800	Oz. Ag.
	.0033	Oz. Au.

Plaintiffs' Exhibit No. 261

UNITED STATES OF AMERICA,
DISTRICT OF MONTANA—ss.

CHAS. BOCKING, being first duly sworn on oath, deposes and says:

That he is the cashier of the Butte and Superior Copper Company, Limited (now Butte and Superior Mining Company), and makes this affidavit for and on its behalf; that he has read the foregoing statement and knows the contents thereof; that such approximate estimates in said report are set forth under paragraphs 1 to 6 inclusive; that as to the analysis and assay returns of this from the oil flotation plant under paragraph 7 of said statement the same is not an approximate estimate, but that the percentages and weights contained in the answer thereto are accurate, to the best of his knowledge, information and belief.

CHAS. BOCKING.

Subscribed and sworn to before me this 19th day of June, 1916.

A. C. KREMER,

Notary Public for the State of Montana, residing at Butte, Montana.

My commission expires Sept. 5th, 1916.

Filed May 18, 1917.

GEO. W. SPROULE, Clerk.
By H. H. WALKER. Deputy.

Plaintiffs' Exhibit No. 262.

IN THE DISTRICT COURT OF THE UNITED STATES, FOR THE DISTRICT OF MONTANA.

MINERAL SEPARATION, LIMITED, Plaintiff, vs. BUTTE & SUPERIOR MINING COMPANY, formerly BUTTE & SUPERIOR COPPER COMPANY, LIMITED, Defendant.	NO. 6 IN EQUITY.

STATEMENT OF BUTTE AND SUPERIOR MINING COMPANY (FORMERLY BUTTE AND SUPERIOR COPPER COMPANY, LIMITED) FOR THE MONTH OF JUNE, 1916, FILED PURSUANT TO ORDER OF COURT ENTERED IN THE ABOVE ENTITLED CAUSE ON NOVEMBER 15TH, 1913.

Comes now Butte and Superior Mining Company (formerly Butte and Superior Copper Company, Limited), and in compliance with the order of Court en-

Plaintiffs' Exhibit No. 262

tered in the above entitled cause on the 15th day of November, 1913, files the following statement showing an approximate estimate for the month of June, 1916:

1. Of the amount of ore treated in its oil flotation plant	48,474.8705	Tons.
2. Of the amount of concentrates recovered in its oil flotation plant	10,830.4620	"
3. Of the analysis and assay returns of heads in its oil flotation plant	12.9759%	Zn.
	.6248%	Pb.
	.1553%	Cu.
	1.4105%	Fe.
	1.4237%	Mn.
	73.0231%	Insol.
	5.1841	Oz. Ag.
	.0089	Oz. Au.
4. Of the analysis and assay returns of concentrates recovered in its oil flotation plant	54.579%	Zn.
	3.125%	Pb.
	.586%	Cu.
	2.283%	Fe.
	.260%	Mn.
	8.320%	Insol.
	22.154	Oz. Ag.
	.0361	Oz. Au.

Plaintiffs' Exhibit No. 262

5. Of the cost of flotation per ton of concentrates recovered in its oil flotation plant $ 3.2105

6. Of the value per ton of concentrates recovered in its oil flotation plant...............$49.44

The figures set forth under the foregoing six paragraphs are, as noted, approximate estimates, for the reason that at the date of the filing of this statement no exact information has been acquired by the Butte and Superior Mining Company (formerly Butte and Superior Copper Company, Limited), so that accurate figures can be given.

7. As to the analysis and assay returns of tails from the oil flotation plant the following figures are accurate and not estimates .... 1.0766% Zn.

1.0766%	Zn.
.0800%	Pb.
.0400%	Cu.
.7500%	Fe.
1.7000%	Mn.
88.5500%	Insol.
.7300	Oz. Ag.
.0025	Oz. Au.

Plaintiffs' Exhibit No. 262

UNITED STATES OF AMERICA,
DISTRICT OF MONTANA—ss.

CHAS. BOCKING, being first duly sworn on oath, deposes and says:

That he is the cashier of the Butte and Superior Mining Company (formerly Butte and Superior Copper Company, Limited) and makes this affidavit for and on its behalf; that he has read the foregoing statement and knows the contents thereof; that such approximate estimates in said report are set forth under paragraphs 1 to 6 inclusive; that as to the analysis and assay returns of this from the oil flotation plant under paragraph 7 of said statement the same is not an approximate estimate, but that the percentages and weights contained in the answer thereto are accurate, to the best of his knowledge, information and belief.

CHAS. BOCKING.

Subscribed and sworn to before me this 20th day of July, 1916.

A. C. KREMER,

Notary Public for the State of Montana, residing at Butte, Montana.

My commission expires Sept. 5th, 1916.

Filed May 18, 1917.

GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Plaintiffs' Exhibit No. 263.

IN THE DISTRICT COURT OF THE UNITED STATES, FOR THE DISTRICT OF MONTANA.

MINERALS SEPARATION, LIMITED, Plaintiff, vs. BUTTE & SUPERIOR MINING COMPANY, formerly BUTTE & SUPERIOR COPPER COMPANY, LIMITED, Defendant.	NO. 8 IN EQUITY.

STATEMENT OF BUTTE AND SUPERIOR MINING COMPANY (FORMERLY BUTTE AND SUPERIOR COPPER COMPANY, LIMITED) FOR THE MONTH OF JULY, 1916, FILED PURSUANT TO ORDER OF COURT ENTERED IN THE ABOVE ENTITLED CAUSE ON NOVEMBER 15TH, 1913.

Comes now Butte and Superior Mining Company (formerly Butte and Superior Copper Company, Limited), and in compliance with the order of Court entered in the above entitled cause on the 15th day of

Plaintiffs' Exhibit No. 263

November, 1913, files the following statement showing an approximate estimate for the month of July, 1916:

1. Of the amount of ore treated in its oil flotation plant	45,874.287	Tons.
2. Of the amount of concentrates recovered in its oil flotation plant	8,685.416	"
3. Of the analysis and assay returns of heads in its oil flotation plant	11.4907%	Zn.
	.8030%	Pb.
	.1427%	Cu.
	1.6479%	Fe.
	1.8797%	Mn.
	73.6796%	Insol.
	4.6771	Oz. Ag.
	.0082	Oz. Au.
4. Of the analysis and assay returns of concentrates recovered in its oil flotation	54.000%	Zn.
	3.168%	Pb.
	.611%	Cu.
	2.180%	Fe.
	.329%	Mn.
	8.706%	Insol.
	23.161	Oz. Ag.
	.030	Oz. Au.
5. Of the cost of flotation per ton of concentrates recovered in its oil flotation plant	$ 3.64	

Plaintiffs' Exhibit No. 263

6. Of the value per ton of concentrates recovered in its oil flotation plant..................$48.83

The figures set forth under the foregoing six paragraphs are, as noted, approximately estimates, for the season that at the date of the filing of this statement no exact information has been acquired by the Butte and Superior Mining Company, so that accurate figures can be given.

7. As to the analysis and assay returns of tails from the oil flotation plant the following figures are accurate and not estimates

1.0760%	Zn.
.0600%	Pb.
.0300%	Cu.
.7600%	Fe.
2.0000%	Mn.
89.8400%	Insol.
.7400	Oz. Ag.
.00208	Oz. Au.

Plaintiffs' Exhibit No. 263

UNITED STATES OF AMERICA,
DISTRICT OF MONTANA—ss.

CHAS. BOCKING, being first duly sworn on oath, deposes and says:

That he is the cashier of the Butte and Superior Mining Company (formerly Butte and Superior Copper Company, Limited), and makes this affidavit for and on its behalf; that he has read the foregoing statement and knows the contents thereof; that such approximate estimates in said report are set forth under paragraphs 1 to 6 inclusive; that as to the analysis and assay returns of this from the oil flotation plant under paragraph 7 of said statement the same is not an approximate estimate, but that the percentages and weights contained in the answer thereto are accurate, to the best of his knowledge, information and belief.

CHAS. BOCKING.

Subscribed and sworn to before me this............day of August, 1916.

....

Notary Public for the State of Montana, residing at Butte, Montana.

My commission expires ....

Filed May 18, 1917.

GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Plaintiffs' Exhibit No. 264.

IN THE DISTRICT COURT OF THE UNITED STATES, FOR THE DISTRICT OF MONTANA.

MINERALS SEPARATION, LIMITED Plaintiff, vs. BUTTE & SUPERIOR MINING COMPANY, formerly BUTTE & SUPERIOR COPPER COMPANY, LIMITED, Defendant.	NO. 8 IN EQUITY.

STATEMENT OF BUTTE AND SUPERIOR MINING COMPANY (FORMERLY BUTTE AND SUPERIOR COPPER COMPANY, LIMITED) FOR THE MONTH OF AUGUST, 1916, FILED PURSUANT TO ORDER OF COURT ENTERED IN THE ABOVE ENTITLED CAUSE ON NOVEMBER 15TH, 1913.

Comes now Butte and Superior Mining Company (formerly Butte and Superior Copper Company, Limited) and in compliance with the order of Court entered in the above entitled cause on the 15th day of

Plaintiffs' Exhibit No. 264

November, 1913, files the following statement, showing an approximate estimate for the month of August, 1916:

1. Of the amount of ore treated in its oil flotation plant .... 31,733.120 Tons.
2. Of the amount of concentrates recovered in its oil flotation plant .... 7,502.243 "
3. Of the analysis and assay returns of heads in its oil flotation plant.... 13.4892% Zn.

.7759%	Pb.
.1603%	Cu.
1.7436%	Fe.
1.8357%	Mn.
70.3365%	Insol.
6.2148	Oz. Ag.
.0089	Oz. Au.

4. Of the analysis and assay returns of concentrates recovered in its oil flotation plant .... 54.290% Zn.

2.912%	Pb.
.575%	Cu.
2.322%	Fe.
.310%	Mn.
8.862%	Insol.
23.117	Oz. Ag.
.040	Oz. Au.

5. Of the cost of flotation per ton of concentrates recovered in its oil flotation plant $ 4.8860

Plaintiffs' Exhibit No. 264

6. Of the value per ton of concentrates recovered in its oil flotation plant.............. 49.4500

The figures set forth under the foregoing six paragraphs are, as noted, approximate estimates, for the reason that at the date of the filing of this statement no exact information has been acquired by the Butte and Superior Mining Company, so that accurate figures can be given.

7. As to the analysis and assay returns of tails from the oil flotation plant the following figures are accurate, and not estimates ....

1.0000%	Zn.
.0600%	Pb.
.0200%	Cu.
.5600%	Fe.
1.8500%	Mn.
90.5900%	Insol.
.8300	Oz. Ag.
.0013	Oz. Au.

Plaintiffs' Exhibit No. 264

UNITED STATES OF AMERICA,
DISTRICT OF MONTANA—ss.

J. L. BRUCE, being first duly sworn on oath, deposes and says:

That he is the Manager of the Butte and Superior Mining Company (formerly Butte and Superior Copper Company, Limited), and makes this affidavit for and on its behalf; that he has read the foregoing statement and knows the contents thereof; that such approximate estimates in said report are set forth under paragraphs 1 to 6 inclusive; that as to the analysis and assay returns of this from the oil flotation plant under paragraph 7 of said statement the same is not an approximate estimate, but that the percentages and weights contained in the answer thereto are accurate, to the best of his knowledge, information and belief.

J. L. BRUCE.

Subscribed and sworn to before me this............day of September, 1916.

LOUIS P. SANDERS,

Notary Public for the State of Montana, residing at Butte, Montana.

My commission expires July 14th, 1918.

Filed May 18, 1917.

GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Plaintiffs' Exhibit No. 265.

IN THE DISTRICT COURT OF THE UNITED STATES, FOR THE DISTRICT OF MONTANA.

MINERALS SEPARATION, LIMITED, *Plaintiff* vs. BUTTE & SUPERIOR MINING COMPANY, Formerly BUTTE & SUPERIOR COPPER COMPANY, LIMITED, *Defendant.*	No. 8 IN EQUITY

STATEMENT OF BUTTE AND SUPERIOR MINING COMPANY (FORMERLY BUTTE AND SUPERIOR COPPER COMPANY, LIMITED) FOR THE MONTH OF SEPTEMBER, 1916, FILED PURSUANT TO ORDER OF COURT ENTERED IN THE ABOVE ENTITLED CAUSE ON NOVEMBER 15th, 1913.

Comes now Butte and Superior Mining Company (formerly Butte and Superior Copper Company, Limited) and in compliance with the order of Court entered in the above entitled cause on the 15th day of November, 1913, files the following statement, show-

Plaintiffs' Exhibit No. 265

ing an approximate estimate for the month of September, 1916.

1.	Of the amount of ore treated in its oil flotation plant...............	48809.7815 Tons
2.	Of the amount of concentrates recovered in its oil flotation plant	12694.2915 "
3.	Of the analysis and assay returns of heads in its oil flotation plant..	14.8415% Zn.
		.9494% Pb.
		.1534% Cu.
		2.5475% Fe.
		1.7308% Mn.
		66.8589% Insol.
		6.1882 Oz. Ag.
		.0058 Oz. Au.
4.	Of the analysis and assay returns of concentrates recovered in its oil flotation plant..........	53.659 % Zn.
		3.167 % Pb.
		.509 % Cu.
		3.010 % Fe.
		.303 % Mn.
		8.672 % Insol.
		21.720 Oz. Ag.
		.0322 " Au.

5. Of the cost of flotation per ton of concentrates recovered in its oil flotation plant..$3.1725
6. Of the value per ton of concentrates recovered in its oil flotation plant.................$48.69

Plaintiffs' Exhibit No. 265

The figures set forth under the foregoing six paragraphs are, as noted, approximate estimates, for the reason that at the date of the filing of this statement no exact information has been acquired by the Butte and Superior Mining Company, so that accurate figures can be given.

7. As to the analysis and assay returns of tails from the oil flotation plant, the following figures are accurate, and not estimates	1.0900%	Zn.
	.0600%	Pb.
	.0800%	Cu.
	.8000%	Fe.
	2.0000%	Mn.
	88.4000%	Insol.
	.7900	Oz. Ag.
	.0020	Oz. Au.

Plaintiffs' Exhibit No. 265

UNITED STATES OF AMERICA,
DISTRICT OF MONTANA,—ss:

CHAS. BOCKING, being first duly sworn on oath, deposes and says:

That he is the Cashier of the Butte and Superior Mining Company, and makes this affidavit for and on its behalf; that he has read the foregoing statement and knows the contents therof: that the approximate estimates therein set forth are true to the best of his knowledge, information and belief: that such approximate estimates in said report are set forth under paragraphs 1 to 6, inclusive: that as to the analysis and assay returns of this from the oil flotation plant under paragraph 7 of said statement, the same is not an approximate estimate, but that the percentages and weights contained in the answer thereto are accurate, to the best of his knowledge, information and belief.

CHAS. BOCKING.

Subscribed and sworn to before me this 20th day of October, 1916.

ALF C. KREMER,

Notary Public for the State of Montana, residing at Butte, Montana. My commission expires October 2nd, 1919.

Filed May 18, 1917.

GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Plaintiffs' Exhibit No. 266.

IN THE DISTRICT COURT OF THE UNITED STATES, FOR THE DISTRICT OF MONTANA.

MINERALS SEPARATION, LIMITED, Plaintiff, vs. BUTTE & SUPERIOR MINING COMPANY, Formerly BUTTE & SUPERIOR COPPER COMPANY, LIMITED, Defendant.	No. 8 IN EQUITY.

STATEMENT OF BUTTE AND SUPERIOR MINING COMPANY (FORMERLY BUTTE AND SUPERIOR COPPER COMPANY, LIMITED) FOR THE MONTH OF OCTOBER, 1916, FILED PURSUANT TO ORDER OF COURT ENTERED IN THE ABOVE ENTITLED CAUSE ON NOVEMBER 15th, 1913.

Comes now Butte and Superior Mining Company (formerly Butte and Superior Copper Company, Limited) and in compliance with the order of court entered in the above entitled cause on the 15th day

Plaintiffs' Exhibit No. 266

of November, 1913, files the following statement, showing an approximate estimate for the month of October, 1916.

1. Of the amount of ore treated in its oil flotation plant........................53541.866 Tons
2. Of the amount of concentrates recovered in its oil flotation plant..14191.495 Tons
3. Of the analysis and assay returns of heads in its flotation plant ....

15.1280%	Zn.
1.1496%	Pb.
.1969%	Cu.
2.3807%	Fe.
1.7144%	Mn.
66.7682%	Insol.
6.0501	Oz. Ag.
.0062	Oz. Au.

4. Of the analysis and assay returns of concentrates recovered in its oil flotation ....

53.414%	Zn.
3.830%	Pb.
.545%	Cu.
2.587%	Fe.
.280%	Mn.
8.731%	Insol.
21.595	Oz. Ag.
.033	Oz. Au.

5. Of the cost of flotation per ton of concentrates recovered in its oil flotation plant................$ 2.8268

Plaintiffs' Exhibit No. 266

6. Of the value per ton of concentrates recovered in its oil flotation plant ....$ 56.89

The figures set forth under the foregoing six paragraphs are, as noted, approximate estimates, for the reason that at the date of the filing of this statement no exact information has been acquired by the Butte and Superior Mining Company, so that accurate figures can be given.

7. As to the analysis and assay returns of tails from the oil flotation plant, the following figures are accurate, and not estimates ....

1.3140%	Zn.
.0800%	Pb.
.0400%	Cu.
.6000%	Fe.
1.8500%	Mn.
90.2400%	Insol
.7800	Oz. Ag.
.0013	Oz. Au.

Plaintiffs' Exhibit No. 266

UNITED STATES OF AMERICA,
DISTRICT OF MONTANA,—ss:

CHAS. BOCKING, being first duly sworn on oath, deposes and says:

That he is the Cashier of the Butte and Superior Mining Company, and makes this affidavit for and on its behalf; that he has read the foregoing statement and knows the contents thereof; that the approximate estimates therein set forth are true to the best of his knowledge, information and belief; that such approximate estimates in said report are set forth under paragraphs 1 to 6, inclusive; that as to the analysis and assay returns of this form the oil flotation plant under paragraph 7 of said statement, the same is not an approximate estimate, but that the percentages and weights contained in the answer thereto are accurate, to the best of his knowledge, information and belief.

CHAS. BOCKING.

Subscribed and sworn to before me this 20th day of November, 1916.

ALF C. KREMER,

Notary Public for the State of Montana, residing at Butte, Montana.
My commission expires October 2nd, 1919.

Filed May 18, 1917.

GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Plaintiffs' Exhibit No. 267.

N THE DISTRICT COURT OF THE UNITED STATES, FOR THE DISTRICT OF MONTANA.

MINERALS SEPARATION, LIMITED, Plaintiff,	
vs.	
BUTTE & SUPERIOR MINING COMPANY, Formerly BUTTE & SUPERIOR COPPER COMPANY, LIMITED, Defendant.	No. 8 IN EQUITY.

STATEMENT OF BUTTE AND SUPERIOR MINING COMPANY (FORMERLY BUTTE AND SUPERIOR COPPER COMPANY, LIMITED) FOR THE MONTH OF NOVEMBER, 1916, FILED PURSUANT TO ORDER OF COURT ENTERED IN THE ABOVE ENTITLED CAUSE ON NOVEMBER 15th, 1913.

Comes now Butte and Superior Mining Company formerly Butte and Superior Copper Company, Limted) and in compliance with the order of Court entered n the above entitled cause on the 15th day of November, 1913, files the following statement, showing an approximate estimate for the month of November, 1916.

1. Of the amount of ore treated in its oil flotation plant......................50494.8475 Tons
2. Of the amount of concentrates recovered in its oil flotation plant ....11398.124 Tons.
3. Of the analysis and assay returns of heads in its oil flotation plant .... 13.0008% Zn.
   .7664% Pb.
   .1450% Cu.
   1.6273% Fe.
   1.5276% Mn.
   71.5711% Insol.
   5.2188 Oz. Ag.
   .00949 Oz. Au.
4. Of the analysis and assay returns of concentrates recovered in its oil flotation ....53.524% Zn.
   3.544% Pb.
   .491% Cu.
   2.487% Fe.
   .307% Mn.
   8.730% Insol.
   21.749 Oz. Ag.
   .0313 Oz. Au.
5. Of the cost of flotation per ton of concentrates recovered in its oil flotation plant ....$ 3.5814

Plaintiffs' Exhibit No. 267

Of the value per ton of concentrates recovered in its oil flotation plant ....$ 55.3200

The figures set forth under the foregoing six para-
raphs are, as noted, approximate estimates; for the
ason that at the date of the filing of this statement
o exact information has been acquired by the Butte
nd Superior Mining Company, so that accurate figures
an be given.

As to the analysis and assay returns of tails from the oil flotation plant, the following figures are accurate, and not estimates .... .941% Zn.

.050%	Pb.
.020%	Cu.
.660%	Fe.
1.850%	Mn.
91.030%	Insol.
.720	Oz. Ag.
.001254	Oz. Au.

Plaintiffs' Exhibit No. 267

UNITED STATES OF AMERICA,
DISTRICT OF MONTANA,—ss:

CHAS. BOCKING, being first duly sworn on oath deposes and says:

That he is the Cashier of the Butte and Superior Mining Company, and makes this affidavit for and on its behalf; that he has read the foregoing statement and knows the contents thereof; that the approximate estimates therein set forth are true to the best of his knowledge, information and belief; that such approximate estimates in said report are set forth under paragraphs 1 to 6, inclusive; that as to the analysis and assay returns of this from the oil flotation plant under paragraph 7 of said statement, the same is not an approximate estimate, but that the percentages and weights contained in the answer thereto are accurate, to the best of his knowledge, information and belief.

CHAS. BOCKING.

Subscribed and sworn to before me this 20th day of January, 1917.

C. K. TUOHY,
Notary Public for the State of Montana, residing at Butte, Montana. My commission expires July 7th, 1918.

Filed May 18, 1917.

GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Plaintiffs' Exhibit No. 268.

IN THE DISTRICT COURT OF THE UNITED STATES, FOR THE DISTRICT OF MONTANA.

MINERALS SEPARATION, LIMITED, Plaintiff, vs. BUTTE & SUPERIOR MINING COMPANY, Formerly BUTTE & SUPERIOR COPPER COMPANY, LIMITED, Defendant.	No. 8 IN EQUITY.

STATEMENT OF BUTTE AND SUPERIOR MINING COMPANY (FORMERLY BUTTE AND SUPERIOR COPPER COMPANY, LIMITED) FOR THE MONTH OF DECEMBER, 1916, FILED PURSUANT TO ORDER OF COURT ENTERED IN THE ABOVE ENTITLED CAUSE ON NOVEMBER 15th, 1913.

Comes now Butte and Superior Mining Company (formerly Butte and Superior Copper Company, Limited) and in compliance with the order of Court entered in the above entitled cause on the 15th day of November, 1913, files the following statement, showing an approximate estimate for the month of December, 1916.

1. Of the amount of ore treated in its oil flotation plant..................52886.3455 Tons
2. Of the amount of concentrates recovered in its oil flotation plant ....11234.729 Tons
3. Of the analysis and assay returns of heads in its flotation plant ....12.1680% Zn.

12.1680%	Zn.
.7428%	Pb.
.1630%	Cu.
1.7395%	Fe.
1.4729%	Mn.
71.0963%	Insol.
5.2329	Oz. Ag.
.0079	Oz. Au.

4. Of the analysis and assay returns of concentrates recovered in its oil flotation............52.779% Zn.

52.779%	Zn.
3.241%	Pb.
.515%	Cu.
2.291%	Fe.
.280%	Mn.
11.065%	Insol.
21.093	Oz. Ag.
.027	Oz. Au.

Plaintiffs' Exhibit No. 268

5. Of the cost of flotation per ton of concentrates recovered in its oil flotation plant ....$ 4.3060

6. Of the value per ton of concentrates recovered in its oil flotation plant ....$ 57.01

The figures set forth under the foregoing six paragraphs are, as noted, approximate estimates; for the reason that at the date of the filing of this statement no exact information has been acquired by the Butte and Superior Mining Company, so that accurate figures can be given.

7. As to the analysis and assay returns of tails from the oil flotation plant, the following figures are accurate, and not estimates .... 1.124% Zn.

1.124%	Zn.
.070%	Pb.
.030%	Cu.
.760%	Fe.
1.700%	Mn.
90.180%	Insol.
.880	Oz. Ag.
.008	Oz. Au.

Plaintiffs' Exhibit No. 268

UNITED STATES OF AMERICA,
DISTRICT OF MONTANA,—ss:

CHAS. BOCKING, being first duly sworn on oath, deposes and says:

That he is the Cashier of the Butte and Superior Mining Company, and makes this affidavit for and on its behalf; that he has read the foregoing statement and knows the contents thereof; that the approximate estimates therein set forth are true to the best of his knowledge, information and belief; that such approximate estimates in said report are set forth under paragraphs 1 to 6, inclusive; that as to the analysis and assay returns of this from the oil flotation plant under paragraph 7 of said statement, the same is not an approximate estimate, but that the percentages and weights contained in the answer thereto are accurate, to the best of his knowledge, information and belief.

CHAS. BOCKING.

Subscribed and sworn to before me this 20th day of January, 1917.

C. K. TUOHY,

Notary Public for the State of Montana, residing at Butte, Montana. My commission expires July 7th, 1918.

Filed May 18, 1917.

GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Plaintiffs' Exhibit No. 269.

IN THE DISTRICT COURT OF THE UNITED STATES, FOR THE DISTRICT OF MONTANA.

MINERALS SEPARATION, LIMITED, Plaintiff, vs. BUTTE & SUPERIOR MINING COMPANY, Formerly BUTTE & SUPERIOR COPPER COMPANY, LIMITED, Defendant.	IN EQUITY. No. 8

STATEMENT OF BUTTE AND SUPERIOR MINING COMPANY (FORMERLY BUTTE AND SUPERIOR COPPER COMPANY, LIMITED) FOR THE MONTH OF JANUARY, 1917, FILED PURSUANT TO ORDER OF COURT ENTERED IN THE ABOVE ENTITLED CAUSE ON NOVEMBER 15th, 1913.

Comes now Butte and Superior Mining Company and in compliance with the order of Court entered in the above entitled cause on the 15th day of November, 1913, files the following statement, showing an approximate estimate for the month of January, 1917.

1. Of the amount of ore treated in its oil flotation plant	46048.870	Tons
2. Of the amount of concentrates recovered in its oil flotation plant	10100.4635	Tons
3. Of the analysis and assay returns of heads in its flotation plant	12.9230%	Zn.
	1.0180%	Pb.
	.1780%	Cu.
	1.9858%	Fe.
	1.4932%	Mn.
	71.8252%	Insol.
	5.6810	Oz. Ag.
	.00855	Oz. Au.
4. Of the analysis and assay returns of concentrates recovered in its oil flotation	48.820%	Zn.
	3.904%	Pb.
	.477%	Cu.
	2.623%	Fe.
	.343%	Mn.
	14.200%	Insol.
	19.092	Oz. Ag.
	.032	Oz. Au.

Plaintiffs' Exhibit No. 269

5. Of the cost of flotation per ton of concentrates recovered in its oil flotation .... $ 6.2790

6. Of the value per ton of concentrates recovered in its oil flotation plant .... $ 54.5000

The figures set forth under the foregoing six paragraphs are, as noted, approximate estimates, for the reason that at the date of the filing of this statement no exact information has been acquired by the Butte and Superior Mining Company, so that accurate figures can be given.

7. As to the analysis and assay returns of tails from the oil flotation plant, the following figures are accurate, and not estimates ....

2.6120%	Zn.
.0600%	Pb.
.0400%	Cu.
.6400%	Fe.
1.6000%	Mn.
88.4000%	Insol.
1.1200	Oz. Ag.
.0013	Oz. Au.

Plaintiffs' Exhibit No. 269

UNITED STATES OF AMERICA,
DISTRICT OF MONTANA,—ss:

CHAS. BOCKING, being first duly sworn on oath, deposes and says:

That he is the Cashier of the Butte and Superior Mining Company, and makes this affidavit for and on its behalf; that he has read the foregoing statement and knows the contents thereof; that the approximate estimates therein set forth are true to the best of his knowledge, information and belief; that such approximate estimates in said report are set forth under paragraphs 1 to 6, inclusive; that as to the analysis and assay returns of this from the oil flotation plant under paragraph 7 of said statement, the same is not an approximate estimate, but that the percentages and weights contained in the answer thereto are accurate, to the best of his knowledge, information and belief.

CHAS. BOCKING.

Subscribed and sworn to before me
this 20th day of February, 1917.

C. K. TUOHY,

Notary Public for the State of Montana, residing at Butte, Montana.
My commission expires July 7th, 1918.

Filed May 18, 1917.

GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Plaintiffs' Exhibit No. 270.

IN THE DISTRICT COURT OF THE UNITED STATES, FOR THE DISTRICT OF MONTANA.

MINERALS SEPARATION, LIMITED, Plaintiff, vs. BUTTE & SUPERIOR MINING COMPANY, Formerly BUTTE & SUPERIOR COPPER COMPANY, LIMITED, Defendant.	No. 8 IN EQUITY.

STATEMENT OF BUTTE AND SUPERIOR MINING COMPANY (FORMERLY BUTTE AND SUPERIOR COPPER COMPANY, LIMITED) FOR THE MONTH OF FEBRUARY, 1917, FILED PURSUANT TO ORDER OF COURT ENTERED IN THE ABOVE ENTITLED CAUSE ON NOVEMBER 15th, 1913.

Comes now Butte and Superior Mining Company and in compliance with the order of Court entered

Plaintiffs' Exhibit No. 270

in the above entitled cause on the 15th day of November, 1913, files the following statement, showing an approximate estimate for the month of February, 1917

1. Of the amount of ore treated in its oil flotation plant..............43216.8605 Tons

2. Of the amount of concentrates recovered in its oil flotation plant ....9980.6145 Tons

3. Of the analysis and assay returns of heads in its oil flotation plant ....12.9875% Zn.

.9091%	Pb.
.1699%	Cu.
1.9109%	Fe.
1.2430%	Mn.
71.6749%	Insol.
5.2422	Oz. Ag.
.0097	Oz. Au.

4. Of the analysis and assay returns of concentrates recovered in its oil flotation..............45.6390% Zn.

3.6760%	Pb.
.5060%	Cu.
2.7280%	Fe.
.5680%	Mn.
19.1930%	Insol.
17.4720	Oz. Ag.
.0275	Oz. Au.

Plaintiffs' Exhibit No. 270

5. Of the cost of flotation per ton of concentrates recovered in its oil flotation plant..................$ 5.5544

6. Of the value per ton of concentrates recovered in its oil flotation plant ....$ 50.084

The figures set forth under the foregoing six paragraphs are, as noted, approximate estimates; for the reason that at the date of the filing of this statement no exact information has been acquired by the Butte and Superior Mining Company, so that accurate figures can be given.

7. As to the analysis and assay returns of tails from the oil flotation plant, the following figures are accurate, and not estimates ....

1.9560%	Zn
.0800%	Pb.
.0380%	Cu.
.6200%	Fe.
1.5000%	Mn.
90.0000%	Insol.
.8500	Oz. Ag.
.0018	Oz. Au.

Plaintiffs' Exhibit No. 270

UNITED STATES OF AMERICA,
DISTRICT OF MONTANA,—ss:

CHAS. BOCKING, being first duly sworn on oath, deposes and says:

That he is the Cashier of the Butte and Superior Mining Company, and makes this affidavit for and on its behalf; that he has read the foregoing statement and knows the contents thereof; that the approximate estimates therein set forth are true to the best of his knowledge, information and belief; that such approximate estimates in said report are set forth under paragraphs 1 to 6, inclusive; that as to the analysis and assay returns of this from the oil flotation plant under paragraph 7 of said statement, the same is not an approximate estimate, but that the percentages and weights contained in the answer thereto are accurate, to the best of his knowledge, information and belief.

CHAS. BOCKING.

Subscribed and sworn to before me this 20th day of March, 1917.

C. K. TUOHY,
Notary Public for the State of Montana, residing at Butte, Montana.
My commission expires July 7th, 1918.

Filed May 18, 1917.

GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Plaintiffs' Exhibit No. 271.

N THE DISTRICT COURT OF THE UNITED STATES, FOR THE DISTRICT OF MONTANA.

INERALS SEPARATION, LIMITED, Plaintiff vs. UTTE & SUPERIOR MINING COMPANY, Formerly BUTTE & SUPERIOR COPPER COMPANY, LIMITED, Defendant.	No. 8 IN EQUITY.

TATEMENT OF BUTTE AND SUPERIOR MINING COMPANY FOR THE MONTH OF MARCH, 1917, FILED PURSUANT TO ORDER OF COURT ENTERED IN THE ABOVE ENTITLED CAUSE ON NOVEMBER 15th, 1913.

Comes now Butte and Superior Mining Company formerly Butte and Superior Copper Company, Limed) and in compliance with the order of Court entered 1 the above entitled cause on the 15th day of November, 1913, files the following statement, showing an approximate estimate for the month of March, 1917

1. Of the amount of ore treated in its oil flotation plant........................47202.599 Tons

2. Of the amount of concentrates recovered in its oil flotation plant ....10642.6505 Tons

3. Of the analysis and assay returns of heads in its oil flotation plant ....12.4893% Zn.

12.4893%	Zn.
.8578%	Pb.
.1598%	Cu.
1.8901%	Fe.
1.4681%	Mn.
73.0481%	Insol.
4.8032	Oz. Ag.
.00584	Oz. Au.

4. Of the analysis and assay returns of concentrates recovered in its oil flotation............47.207% Zn.

47.207%	Zn.
3.700%	Pb.
.489%	Cu.
3.000%	Fe.
.400%	Mn.
16.500%	Insol.
18.240	Oz. Ag.
.0267	Oz. Au.

Plaintiffs' Exhibit No. 271

Of the cost of flotation per ton of concentrates recovered in its oil flotation plant..$ 6.0242

Of the value per ton of concentrates recovered in its oil flotation plant..................$43.81

The figures set forth under the foregoing six para-raphs are, as noted, approximate estimates; for the ason that at the date of the filing of this statement exact information has been acquired by the Butte d Superior Mining Company, so that accurate fig-es can be given.

As to the analysis and assay returns of tails from the oil flotation plant, the following figures are accurate, and not estimates ....

1.997%	Zn.
.115%	Pb.
.040%	Cu.
.800%	Fe.
1.650%	Mn.
89.600%	Insol.
.840	Oz. Ag.
.0012.	Oz. Au.

Plaintiffs' Exhibit No. 271

UNITED STATES OF AMERICA,
DISTRICT OF MONTANA,—ss:

CHAS. BOCKING, being first duly sworn on oath, deposes and says:

That he is the Assistant Manager of the Butte and Superior Mining Company, and makes this affidavit for and on behalf of said company: That the Butte and Superior Mining Company is the defendant in the foregoing action; That he has read the foregoing statement and knows the contents thereof; that the approximate estimates therein set forth are true to the best of his knowledge, information and belief; that such approximate estimates in said report are set forth under paragraphs 1 to 6, inclusive; that as to the analysis and assay returns of this from the oil flotation plant under paragraph 7 of said statement, the same is not an approximate estimate, but that the percentages and weights contained in the answer thereto are accurate, to the best of his knowledge, information and belief.

CHAS. BOCKING.

Subscribed and sworn to before me
this 20th day of April, 1917.

C. K. TUOHY,

Notary Public for the State of Montana, residing at Butte, Montana.
My commission expires July 7th, 1918.

Filed May 18, 1917.

GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Plai

MINERALS SEPARATION, LIMIT

BUTTE & SUPERIOR

Calculated from the Sworn State

PERIOD	ORE DELIVERED TO PLANT			Ratio of Concentration	CONCENT	
	Tons	Assay % Zinc	Zinc Content Tons		Tons	Assay % Zinc
1916—October	53,542	15.128	8099.83	3.77	14191	53.414
November	50,495	13.001	6564.15	4.43	11398	53.524
December	52,886	12.168	6435.17	4.71	11235	52.779
1916—Last Quarter	156,923	13.446	21099.85	4.26	36824	53.254
1917—January	46,049	12.923	5950.91	4.56	10100	48.820
February	43,217	12.988	5613.02	4.33	9981	45.639
March	47,203	12.489	5895.18	4.44	10643	47.207
1917—First Quarter	136,469	12.793	17459.11	4.44	30724	47.228

. 272.

TE & SUPERIOR MINING COMPANY

TION PLANT RESULTS

to the Federal Court, Butte, Mont.

TAILINGS					Oils	Other Reagents	COSTS — $		
Tons (By Difference)	Zinc Contents Tons (By Difference)	Lbs. Zinc Per Ton of Heads	Assay % Zinc Calculated	Assay % Zinc Given			Total	Per Ton Ore	Per Ton Concentrate
9,351	519.85	19.41	1.321	1.314			40,115	0.7492	2.8268
9,097	464.18	18.39	1.187	0.941			40,821	0.8084	3.5814
1,651	505.45	19.12	1.214	1.124			48,378	0.9148	4.3060
0,099	1489.48	19.11	1.240	1.127			129,314	0.8241	3.5117
9,949	1020.09	44.30	2.838	2.612			63,418	1.3772	6.2790
3,236	1057.79	48.95	3.183	1.956			55,438	1.2828	5.5544
6,560	870.94	36.90	2.382	1.997			64,116	1.3583	6.0242
5,745	2948.82	43.22	2.789	2.192			182,972	1.3408	5.9553

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

MINERALS SEPARATION, LIMITED, ET

FLOTAT

Calculated from the Sworn Statements of the Manag

Comparisons made between the results of operation with excess oil with tl the headings to flotation were of as nearly equal Zinc assay as possible. Only t' has been calculated in all cases on the same terms and market price for spelt

PERIOD.	Heading to Flotation			Concentrates					
	Tons	Assay % Zn.	Zinc Contents Tons	Tons	Assay % Zn.	Zinc Contents Tons	% Zn. Recovery (By Contents)	Tons By difference	
916—January	49428	12.496	6176.52	10535	54.593	5751.37	93.117	38893	4 1[illegible]
917—March	47203	12.489	5895.18	10643	47.207	5024.24	85.228	36560	8 9[illegible]
Differences		.007			7.386		7.889		
916—June	48475	12.976	6290.12	10830	54.579	5910.91	93.972	37645	3 2[illegible]
917—February	43217	12.988	5613.02	9981	45.639	4555.23	81.155	33236	10 7[illegible]
Differences		.012			8.940		12.817		
916—November	50495	13.001	6564.85	11398	53.524	6100.67	92.929	39097	4 1[illegible]
917—January	46049	12.923	5950.91	10100	48.820	4930.82	82.858	33236	10 [illegible]
Differences		.078			4.704		10.071		

The figures indicate that the modification of the operating with excess oil to the flotation plant, and that it would be necessary to provide some more equi low oil. The silver loss is also somewhat greater. With the market price of s

FORMULA ADOPTED FOR PURPOSE OF COMPARISON.

APPENDIX "A"—

Conditions of Sale of Zinc Concentrates Taken for the Sake of Making Co parison of the Financial Results of the Period of Working with Excess Oil w Those of 1916:

Assume Market Quotation for Spelter at East St. Louis................$9.50 per 100
(Being below the average for the period in question.)

For One Ton of Concentrate of 45% Zinc..$21
(Being the usual contract price.)

For each one dollar of the market quotation above five dollars ($5.00) add six dollars ($6.00) per ton of concentrate.

For each unit of zinc in the concentrate above forty-five per cent (45%) add ninety cents (90c) per ton of concentrate.

Allowance for freight, loading, and moisture, per dry ton of concentrate........$[illegible]

.273.

ND SUPERIOR MINING COMPANY

LTS.

Superior Company to the Federal Court in Butte.

h small quantities. For this purpose periods have been chosen in which has been taken into account. The sales value of the Zinc Concentrates Figures for oil and acid taken from Defendant's Exhibit No. 158.

% Zinc.	Oils	Acid	Costs			Sales value of concentrates on equal terms as shown on Appendix A (Zinc only)			Profit	
Given	Per Ton of Heading	Per Ton of Heading	Per ton of Heading	Per ton of Concentrates	Total Cost.	Per ton of Heading	Per ton of Concentrates	Total	Per ton of Heading	Per ton of Concentrates
			$	$	$	$	$	$	$	$
1.2008	about 1.7	about 5.00	0.652	3.0583	32219	10.36	48.63	512317	9.71	45.57
1.997	about 22.0	about 10.00	1.3583	6.0242	64116	9.47	41.99	446900	8.11	35.97
			0.706	2.9659	31897	.89	6.64	65417	1.60	9.64
1.0766	about 1.7	about 5.00	0.7170	3.2105	34770	10.86	48.62	526555	10.14	45.41
1.956	about 20.2	about 10.00	1.2828	5.5544	55438	9.37	40.58	405029	8.09	35.03
			0.5658	2.3439	20668	1.49	8.04	121526	2.05	10.38
0.941	about 1.5	about 5.0	0.8084	3.5814	40821	10.76	47.67	543343	9.96	44.09
2.612	about 20.0	about 10.0	1.3772	6.2790	63418	9.53	43.44	438744	8.15	37.16
			0.5688	2.6976	22597	1.23	4.23	104599	1.81	6.93

ease of profit from the Zinc alone of about $1.75 per ton of ore delivered capacity of the plant to what it was with the old operating method with he decrease of profit on one year's tonnage of 580000 would be $1,015,000.

E.—January 1916.

VALUE OF ONE DRY TON OF CONCENTRATE.

for 45% grade			$21.00
increase of grades: Grade	54.59		
Basis	45.00		
Increase	9.59	@ $0.90	8.63
increase in market price: Market price	9.50		
Basis	5.00		
	4.50	@ $6	27.00
			56.63
it, loading and moisture			8.00
			$48.63

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Plaintiffs' Exhibit No. 274.

Estimate of increased revenue to Butte & Superior Copper Co. had it followed wet concentration with flotation during period of milling operations at Basin, Montana, January 1st, 1910, to April 30, 1912:

1910		
Dry tons milled at Basin	94,085	Assay value 20.2% Zn
Conc. produced—tons	22,157	Assay value 47.7% Zn
1911		
Dry tons milled at Basin	148,542	Assay value 20.3% Zn
Conc. produced—tons	34,464	Assay value 49.1% Zn
1912		
Jan. to April, inclusive,		Estimated
estimated tons milled	50,000	Assay value 20.0% Zn
Estimated production, 57% recovery,		
49% grade concentrate	11,630	tons conc.

Total tons treated at Basin	
Jan. 1st, 1910, to Apr. 30, 1912	292,627 tons
Zinc content	59,159 tons
Total tons zinc conc. made at Basin	68,251 tons
Zinc content	33,189 tons
Total recovery at Basin in form of zinc conc	56.1%

Net Smelter Returns		
1910—Net value per ton conc	$19.67	$ 496,099.49
1911—Net value per ton conc	$24.85	875,369.73
1912—Estimated ditto	$26.00	302,380.00
		$1,673,849.22

Operating costs—same period			
1910—Mining & Dev	$3.15 per ton	$296,367.75	
Ore Transp.	.55 per ton	51,746.75	
Milling	1.75 per ton	164,648.75	
1911—Mining & Dev	$3.06 per ton	454,538.52	
Ore Transp.	.26 per ton	38,620.92	
Milling	1.62 per ton	240,638.04	
1913—Estimated:			
Mining & Dev	$3.06 per ton	153,000.00	
Ore Transp.	.26 per ton	13,000.00	
Milling	1.62 per ton	81,000.00	$1,493,560.73
Operating profit at Basin			$ 180,288.49

Plaintiffs' Exhibit No. 274

Total ore treated at Basin		292,627 tons
Zinc conc. produced	68,251 tons	
Lead conc. produced	752	69,003 tons
Total tons tailings to discard		223,624 tons
Containing		25,780 tons of zinc
Calculated % of zinc in discarded tailings		11.34% Zn.

Assume that all discarded tailings were re-ground and treated by flotation at an extra operating cost of 75 cents per ton with results as follows:

Concentrate	55% Zn	24 Oz Ag	.04 Au
Tailings	1.5% Zn		
Recovery	89.25%		

Zinc concentrate produced by flotation from discarded tailings—41,834 tons, containing 23,008.65 tons of zinc.

Value of 41,834 tons zinc concentrate, assumed to have been produced from Basin mill discarded tailings—

55% Zn at average market price	5.67 cents		
24 Oz. Ag. average market price	54 cents		
.04 Oz. Au. @ $19.00		equals	
Value of zinc		$37.19	
Net value Ag. & Au.		3.88	
		$41.07	
Less freight	$7.91		
Loading at Basin	.09		
Mesh penalty	.50	8.50	
Net value per ton		$32.57	
41.834 tons @ $32.57			$1,3~~8~~62,533.38
Less estimated cost of flotation treatment, 223,624 tons @ 75c			167,718.00
Estimated excess operating profit			$1,194,815.38
Deduct for cost of construction of 500 ton flotation plant			90,000.00
Increase in net profit			$1,104,815.38

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Plaintiffs' Exhibit No. 275.

MINERALS SEPARATION LIMITED ET AL VS. BUTTE AND SUPERIOR MINING COMPANY

Comparison of results at Timber Butte and Butte and Superior Mills for 1st quarter of 1917.

Mill	Material	Tons	Tons per cent of feed	Assay Zinc %	Tons of Zn. in products of 100 tons of flotation feed	% Recovery of zinc in flotation products by flotation feed and conc.	% Recovery of zinc in flotation products by flotation conc. and tailing
Timber	Flotation feed	37992.8	100.000	14.295	14.295	100.00	100.00
Butte	Flotation concentrate	9742.6	25.643	54.474	13.969	97.72	96.34
Mill	Flotation tails (given)........	28250.2	74.357	0.714	0.531	3.71	3.64
	Flotation tails (calculated)	28250.2	74.357	0.438	0.326	2.28	....
Butte	Flotation feed	136469	100.000	12.793	12.793	100.00	100.00
&	Flotation concentrate	30724	22.514	47.228	10.632	83.11	86.23
Superior	Flotation tails (given)........	105745	77.486	2.192	1.698	13.27	13.77
Mill	Flotation tails (calculated)	105745	77.486	2.789	2.161	16.89	....

Filed May 18, 1917. GEO. W. SPROULE, Clerk.

By H. H. WALKER, Deputy.

Plaintiffs' Exhibit No. 276.

BOTTLE OF OIL.

(Physical Exhibit)

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Plaintiffs' Exhibit No. 277.

3 REELS FILMS.

(Physical Exhibit)

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Plaintiffs' Exhibit No. 278.

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy

Plaintiffs' Exhibit No. 279.

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Plaintiffs' Exhibit No. 280.

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy

Plaintiffs' Exhibit No. 281.

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Plaintiffs' Exhibit No. 282.

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Plaintiffs' Exhibit No. 283.

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

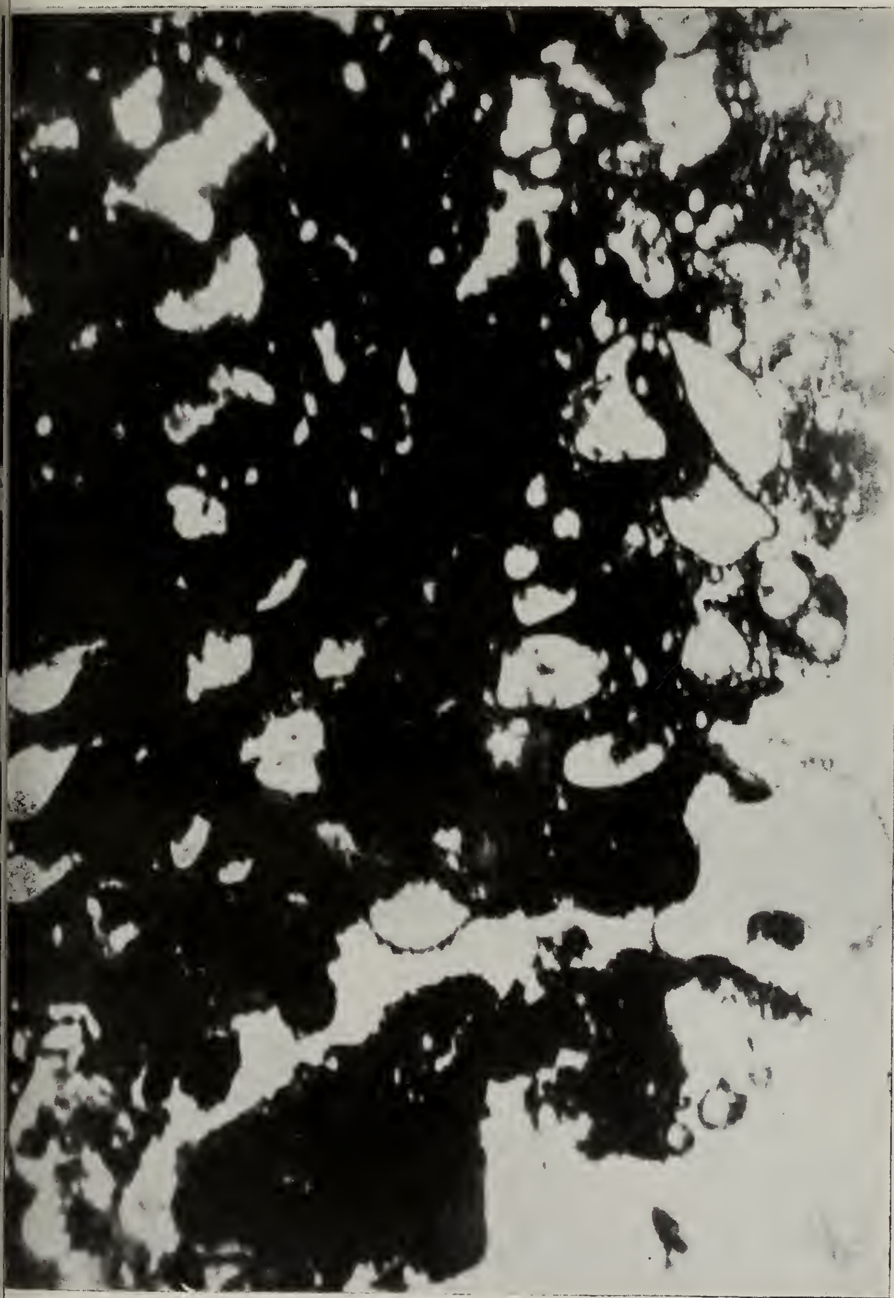
Plaintiffs' Exhibit No. 284.

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Plaintiffs' Exhibit No. 285.

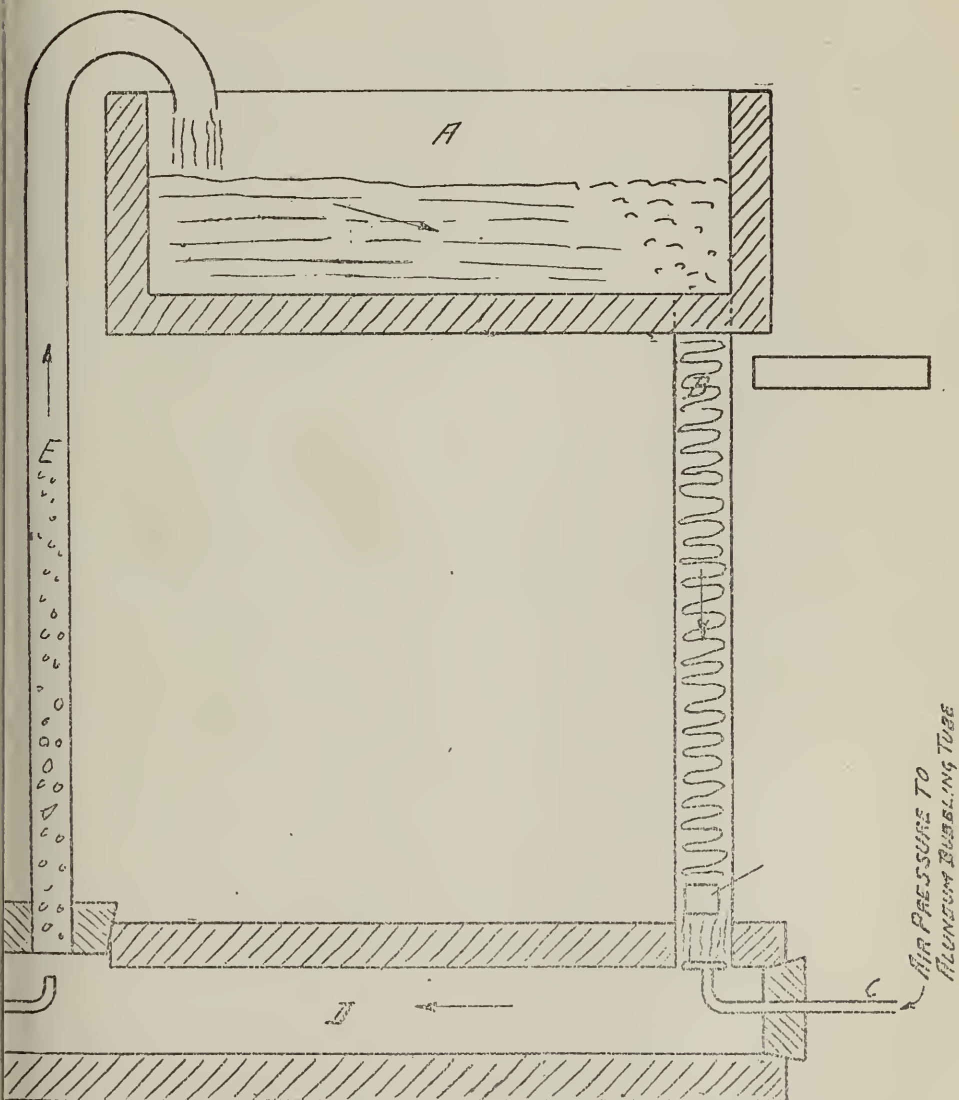
Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Plaintiffs' Exhibit No. 286.



Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

PLAINTIFF'S EXHIBIT NO 287—W. M. G.



Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Plaintiffs' Exhibit No. 288.

(A)

AGREEMENT OF JULY 8, 1913

Between

MINERALS SEPARATION LIMITED

And

MINERALS SEPARATION AMERICAN SYNDICATE (1913) LIMITED.

129802/33 (Companies' Registration
Registered Office 29 Mar. 1916)
95416f
Aug 1913

AN AGREEMENT made the eighth day of July One thousand nine hundred and thirteen BETWEEN MINERALS SEPARATION LIMITED having its registered office at 62 London Wall in the City of London (hereinafter called the Company) of the one part and MINERALS SEPARATION AMERICAN SYNDICATE (1913) LIMITED having its registered Office at 62 London Wall aforesaid (hereinafter called the Syndicate) of the other part. WHEREAS the Syndicate was incorporated on the twenty-seventh day of June One thousand nine hundred and thirteen under the Companies (Consolidation) Act 1908 with a nominal capital of Two hundred and fifty thousand pounds divided into One hundred and twenty-five thousand A shares of One

Plaintiffs' Exhibit No. 288

P. 5459, L. 3, After "Whereas" insert "by Clause 2 of the Articles of Association of the Syndicate"

NOW it is hereby agreed as follows:—

1. The Company shall sell and the Syndicate shall purchase.

First—The Letters Patent and rights mentioned in the Schedule hereto but subject to certain Licenses granted by the Company the dates of which and the names of the Licensees mentioned therein are as follows:—

(A) Twenty fifth June One thousand nine hundred and twelve The Cuba Copper Company.

(B) Nineteenth November One thousand nine hundred and twelve Britannia Mining and Smelting Company Limited as modified by letter dated Seventeenth December One thousand nine hundred and twelve from the Company to the said Britannia Mining and Smelting Company Limited.

(C) Sixteenth January One thousand nine hundred and thirteen The Silverton Mines Limited and Robert Insinger.

(D) Twenty seventh February One thousand nine hundred and thirteen. The Ducktown Sulphur & Copper and Iron Company Limited.

(E) Tenth April One thousand nine hundred and thirteen. The Inspiration Consolidated Copper Company.

Plaintiffs' Exhibit No. 288

(F) Seventh May One thousand nine hundred and thirteen. The Elm Orlu Mining Company.

(G) Seventh May One thousand nine hundred and thirteen. The Colusa Parrot Mining and Smelting Company.

(H) Thirteenth May One thousand nine hundred and thirteen William B. McDonald and Louis S. Nobel.

Secondly: The benefit and rights of the Company of and under the said licenses and of any other licenses that may be granted prior to the completion of the purchase and Thirdly: The exclusive right so far as the Company can confer the same to apply for and obtain in the Republic of Cuba and the Phillipine Islands Patents in connection with any of the Inventions comprised in the Letters Patent and applications mentioned in the Schedule hereto and generally in connection with processes and apparatus for separating different pulverulent materials by oil selection gaseous flotation or other surface Tension phenomena.

2. Part of the consideration for the said sale shall be the sum of Ninety three thousand seven hundred and fifty pounds which shall be paid and satisfied by the allotment to the Company or its nominee or nominees of One hundred and eighty seven thousand five hundred fully paid B shares of Ten shillings each in the Capital of the Syndicate.

3. As the residue of the consideration for the said sale the Syndicate shall indemnify the Company against all liability and obligations of the Company

P. 5461, L. 21, After " Company " insert " All disburse-
nents already made by the Company "

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Plaintiffs' Exhibit No. 288

nder or in respect of any of the licenses granted y them and particulars of which are set out in Clause hereof and shall also indemnify the Company against ll liability and obligations of the Company under or n respect of all costs and charges already or hereafter to be incurred by the Company in connection with applying for and taking out patents in the said Republic of Cuba and the Syndicate shall further indemnify the Company against the liabilities of the Company under a letter dated second day of March One thousand nine hundred and ten from the Company to One James M. Hyde and against all sums which the Company may have been ordered and may be ordered to pay to the said James M. Hyde in connection with certain litigation pending between the Company and the said James M. Hyde in the United States of America and against the costs, charges and expenses of the Company in connection with the said litigation and the Syndicate shall at once repay to the Company on account thereof or in connection therewith. The Syndicate shall be entitled to receive all damages and any other profits or benefits which may be derived from or in connection with the said litigation.

The purchase shall be completed on or before the tenth day of October One thousand nine hundred and thirteen at the registered office of the Syndicate when One hundred and thirty seven thousand five hundred fully paid B shares of Ten shillings each in the Capital of the Syndicate part of the said One hundred and

Plaintiffs' Exhibit No. 288

eighty seven thousand five hundred fully paid B shares shall be allotted to the Company or its nominees and the Company and all other necessary parties if any shall at the expense of the Syndicate, execute and do all assurances and things for vesting in the Syndicate the full benefit of this Agreement as shall be reasonably required. As to fifty thousand fully paid B shares of Ten shillings each in the Capital of the Syndicate the balance of the said One hundred and eighty seven thousand five hundred B shares the same shall be allotted to the Company or its nominees at the rate of Two shares for every one "A" share of One pound each in the initial capital of the Syndicate part of the last Twenty five thousand A shares in such capital which shall be hereafter allotted that is to say when one of such "A" shares shall be allotted there shall be allotted to the Company or its nominees Two of such fully paid "B" shares. No new shares in the Capital of the Syndicate shall be created or issued until the whole of the shares in the initial capital of the Syndicate shall have been allotted.

5. The Company shall with all convenient speed and at cost price communicate to the Syndicate or its assigns all improvements, additions and new discoveries which it shall make or acquire or be interested in either alone or jointly with others in connection with any of the inventions comprised in the Letters Patent mentioned in the Schedule hereto and generally in connection with processes and apparatus for separating pulverulent materials by oil selection, gaseous flotation

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P. 5462, L. 7, After " dicate " insert " or as it shall direct the premises mentioned in the Schedule hereto and giving to the Syndicate "

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capital of

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discoveries
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rs Patent
y in con-
eparating
flotation

Plaintiffs' Exhibit No. 288

r other surface tension phenomena and shall give to he Syndicate or its assigns as full information as may e possible as to the exact mode of working and using uch improvements, additions and new discoveries but ny plans, drawings and models required by the Synicate or its assigns in connection therewith shall be urnished to the Syndicate or its assigns on payment f out of pocket expenses and shall from time to time t the request and at the expense of the Syndicate or ts assigns execute and do all such documents and hings as may be requisite for enabling the Syndicate r its assigns to obtain letters patent in the United States of America and the Dominion of Canada, the Republic of Mexico, the Republic of Cuba and the Philippine Islands for such improvements, additions nd new discoveries.

6. The Syndicate shall with all convenient speed and t cost price communicate to the Company or its assigns all improvements, additions and new discoveries which it shall make or acquire or be interested in either alone or jointly with others in connection with any of the inventions comprised in the letters patent and applications mentioned in the Schedule hereto and generally in connection with processes and apparatus for separating different pulverulent materials by oil selection gaseous flotation or other surface tension phenomena and shall give to the Company or its assigns as full information as possible as to the exact mode of working and using such improvements additions and new discoveries but any plans drawings and

models required by the Company or its assigns in connection therewith shall be furnished to the Company or its assigns on payment of out of pocket expenses and shall from time to time at the request and at the expense of the Company or its assigns execute and do all such documents and things as may be requisite for enabling the Company or its assigns to obtain Letters Patent elsewhere than in the United States of America the Dominion of Canada the Republic of Mexico the Republic of Cuba and the Phillipine Islands for such improvements additions and new discoveries.

7. The Syndicate shall not dispute the validity of any of the patents and patent rights for the time being belonging to the Company nor in any manner support any litigation against the Company. The Company and the Syndicate shall mutually assist each other as far as possible (except financially) in all litigation against infringers or alleged infringers of the said Letters Patent or in respect of Letters Patent which may from time to time be held by or belong to either of them. The Company and the Syndicate shall also mutually assist each other in negotiating for the acquisition upon the best possible terms of new inventions and discoveries and patents for the same or improvements thereof by third parties which it may be considered desirable either to acquire or control in the United States of America the Dominion of Canada the Republic of Mexico the Republic of Cuba or the Phillipine Islands or any other part of the world.

8. The Syndicate shall pay all the costs charges and

Plaintiffs' Exhibit No. 288

expenses of and incident to the preparation and execution of this agreement and of the Syndicate's memorandum and Articles of Association and shall also pay all stamps fees and legal and other expenses incident to the formation and registration of the Syndicate.

9. The Syndicate shall cause this Agreement to be duly filed with the Registrar of Companies pursuant to Section 88 of the Companies (Consolidated) Act 1908 and also in the case of shares allotted to nominees shall cause a sufficient contract to be filed constituting the title of such nominees.

IN WITNESS WHEREOF the Companies parties hereto have caused their respective common seals to be hereto affixed the day and year first above written.

THE SCHEDULE ABOVE REFERRED TO

Part 1.

1. The benefit of the following Letters Patent granted in respect of the United States of America.

No.	Date	Name
777273	13/12/04	Cattermole
763259	21/ 6/04	"
763260	21/ 6/04	"
809959	16/ 1/06	E. B. Kirby
838626	18/12/06	"
763749	28/ 6/04	Goyder & Laughton
784999	14/ 3/05	"

models required by the Company or its assigns in connection therewith shall be furnished to the Company or its assigns on payment of out of pocket expenses and shall from time to time at the request and at the expense of the Company or its assigns execute and do all such documents and things as may be requisite for enabling the Company or its assigns to obtain Letters Patent elsewhere than in the United States of America the Dominion of Canada the Republic of Mexico the Republic of Cuba and the Phillipine Islands for such improvements additions and new discoveries.

7. The Syndicate shall not dispute the validity of any of the patents and patent rights for the time being belonging to the Company nor in any manner support any litigation against the Company. The Company and the Syndicate shall mutually assist each other as far as possible (except financially) in all litigation against infringers or alleged infringers of the said Letters Patent or in respect of Letters Patent which may from time to time be held by or belong 'to either of them. The Company and the Syndicate shall also mutually assist each other in negotiating for the acquisition upon the best possible terms of new inventions and discoveries and patents for the same or improvements thereof by third parties which it may be considered desirable either to acquire or control in the United States of America the Dominion of Canada the Republic of Mexico the Republic of Cuba or the Phillipine Islands or any other part of the world.

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Plaintiffs' Exhibit No. 288

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838626	18/12/06	"
763749	28/ 6/04	Goyder & Laughton
784999	14/ 3/05	"

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No.	Date	Name
864597	27/ 8/07	De Bavay
912783	27/ 8/07	"
776145	29/11/04	C. V. Potter
1045970	3/12/12	Potters. S. O. T. Co.
ser		
683005	11/ 3/12	L. Bradford
793808	4/ 7/05	Sulman & Picard
788247	25/ 4/05	Cattermole Sulman & Picard
777274	13/12/04	"
879985	25/ 2/08	H. L. Sulman
835120	6/11/06	Sulman, Picard & Ballot
835143	6/11/06	H. L. Sulman
835479	6/11/06	Sulman, Picard & Ballot
902018	27/10/08	H. L. Sulman & E. A. Sulman
962678	28/ 6/10	Greenway Sulman & Higgins
953746	5/ 4/10	T. J. Hoover
ser		
587621	17/10/10	Greenway & Lavers
ser		
647239	1/ 9/11	Nutter & Lavers
ser		
636245	30/ 6/11	H. H. Greenway
ser		
665900	4/12/11	E. H. Nutter
ser		
651188	25/ 9/11	Nutter & Hoover

Plaintiffs' Exhibit No. 288

No.	Date	Name
ser 712309	30/ 7/12	Chapman & Tucker
ser 723327	1/10/12	J. Hebbard
738586	26/12/12	Chapman & Tucker
ser 732386	19/12/11	A. C. Howard
955012	12/ 5/10	H. L. Sulman
979857	27/12/10	T. J. Hoover
		Broadbridge & Howard
ser 768374	17/ 4/13	Greenway & Lowry
ser 766250	8/ 5/13	Chapman

2. The benefit of all extensions and prolongations of the terms and priviliges granted by any such Patents as aforesaid.

Part 2.

1. The benefit of the following Letters Patent granted in respect of the Dominion of Canada viz:—

No.	Date	Name
87785	14/ 6/04	Cattermole
87786	14/ 6/04	"
76621	8/ 7/02	C. V. Potter
121676	2/11/09	Potter S. O. T. Co. (T. J. Greenway)
169146	13/ 3/12	"
87700	7/ 6/04	Sulman & Picard

Plaintiffs' Exhibit No. 288

No.	Date	Name
94516	1/ 8/05	Cattermole Sulman & Picard
96183	21/11/05	Sulman Picard & Ballot
96182	21/11/05	"
99743	26/ 6/06	"
127397	9/ 8/10	Greenway Sulman & Higgins
129819	13/12/10	T. J. Hoover
134271	11/ 7/11	Greenway & La~~y~~vers
135089	22/ 8/11	Sulman & Picard
137404	19/12/11	Nutter & Lavers
142607	3/ 9/12	H. H. Greenway
ser		
166434	18/11/11	Nutter & Hoover
147431	22/ 4/13	Chapman & Tucker
ser		
176341	17/ 1/13	J. Hebbard
ser		
175775	26/12/12	Chapman & Tucker
147432	22/ 4/13	A. C. Howard
94718	15/ 8/05	S. S. & Steele
129820	13/12/10	T. J. Hoover
		Broadbridge & Howard
ser		
179523	21/ 5/13	Greenway & Lowry

2. The benefit of all extensions and prolongations of the terms and priviliges granted by any such patents as aforesaid.

Plaintiffs' Exhibit No. 288

Part 3.

1. The benefit of the following Letters Patent granted in respect of the Republic of Mexico.

No.	Date	Name
3397	15/12/03	Cattermole
4268	12/ 1/05	De Bavay
4267	12/ 1/05	"
4269	12/ 1/05	"
3605	24/ 3/04	C. V. Potter
9362	14/ 7/09	Potter S. O. T. Co.
12781	12/ 3/12	Potter S. O. T. Co.
3276	19/10/03	Sulman & Picard
3642	12/ 4/04	Cattermole Sulman & Picard
4908	14/ 9/05	Sullman Picard & Ballot
5560	21/ 4/06	
4907	14/ 9/05	" "
5561	21/ 4/06	" "
4622	27/ 5/05	S. Steele & Steele
4635	1/ 6/05	"
5603	26/ 4/06	Sulman Picard & Ballot
5602	26/ 4/06	"
9422	26/ 7/09	Minerals Separation Ltd.
9592	9/ 9/09	"
11087	19/10/10	"
11898	20/ 7/11	"
11943	6/ 7/11	"
12291	31/10/11	"
12050	11/ 8/11	"

Plaintiffs' Exhibit No. 288

No.	Date	Name
12290	31/10/11	Minerals Separation Ltd.
13316	14/ 8/12	"
13820	8/ 1/13	"
13749	17/12/12	"
13991	6/ 3/13	"

Broadbridge & Howard
Greenway & Lowry

2. The benefit of all extensions and prolongations of the terms and priviliges granted by any such patents as aforesaid.

Part 4.

1. The benefit of the following letters Patent and application for Letters Patent granted in respect of the Republic of Cuba, viz:

No.	Date	Name
1521	2/ 5/11	Minerals Separation Ltd.
1520	2/ 5/11	"

Application for patent filed 26/3/13

2. The benefit of all extensions and prolongations of the terms and privileges granted by any such patents as aforesaid.

The Common seal of Minerals
Separation Ltd. was hereto
affixed in the presence of

John Ballot
W. W. Webster
Directors (Seal)
E. Williams Secretary

Plaintiffs' Exhibit No. 288

The Common Seal of Minerals Separation American Syndicate (1913) Limited was hereto affixed in the presence of

Emil Beer
H. A. Krohm
Directors (Seal)
E. Williams Secretary

A true copy
Geo. J. Sargent
Assistant Registrar of Joint Stock Companies
(Stamp)

Filed May 18, 1917.

GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Plaintiffs' Exhibit No. 289.

BILL OF SALE

From

MINERALS SEPARATION AMERICAN SYNDICATE (1913), LIMITED,

To

MINERALS SEPARATION NORTH AMERICAN CORPORATION.

Know all men by these presents

That MINERALS SEPARATION AMERICAN SYNDICATE (1913), Limited, a company incorporated under the Companies Consolidated Act 1908, having its registered office at No. 62 London Wall, in the City of London, England, for and in consideration of five hundred thousand (500,000) shares, without nominal or par value, of the stock of Minerals Separation North American Corporation, a corporation duly organized and existing under the laws of the State of Maryland, whose principal office is in the Continental Building, in the City of Baltimore, in the State of Maryland, of the assumption by said Minerals Separation North American Corporation of all the debts, liabilities and obligations, contractual or otherwise, of said Minerals Separation American Syndicate (1913), Limited, and for other valuable considerations to it moving by said Minerals Separation North American Corporation, the receipt whereof

Plaintiffs' Exhibit No. 289

is hereby acknowledged, has bargained, sold, assigned, transferred and set over, and by these presents does bargain, sell, assign, transfer and set over to said MINERALS SEPARATION NORTH

Page 2.

AMERICAN CORPORATION, all the patents (subject, however, to all licenses, rights and options heretofore granted in respect thereto), processes, licenses, inventions, applications for patents and all rights, contracts, agreements, concessions, privileges, shares of the capital stock of corporations now owned by said Minerals Separation American Syndicate (1913), Limited, and all the right, title and interest in and to patents (subject, however, to all licenses, rights and options heretofore granted in respect thereto), processes, licenses, inventions and applications for patents, and all rights, contracts, agreements, concessions, privileges, shares of the capital stock of corporations to which said Minerals Separation American Syndicate (1913), Limited, is now or to which it shall hereafter become entitled by virtue of any existing agreements or otherwise, and all the cash on hand and in banks, whether in the Kingdom of Great Britain, the United States of America, or elsewhere, promissory notes, bills of exchange, drafts, outstanding accounts, bills receivable, moneys due and to grow due, royalties due and to grow due, claims and demands ~~and royalties due and to grow due, claims and demands~~ and things in action, office furniture and fixtures and other chattels, and all the business, property and assets of Minerals Separation American Syndicate, (1913), Limited, of every sort, nature or description, including the good will of its business, as a going concern;

TO HAVE AND TO HOLD the same unto MINERALS SEPARATION NORTH AMERICAN CORPORATION, its successors and assigns, to its and their own use absolutely and forever; SUBJECT, HOWEVER, to the payments, discharges and performances as the case may be, of all the debts, liabilities and obligations, contractual or otherwise, of Minerals Separation American Syndicate (1913) Limited.

Page 3.

And for the considerations aforesaid, said Minerals Separation American Syndicate (1913), Limited, covenants and agrees with said Minerals Separation North American Corporation and its successors and with all and every person or persons whomsoever lawfully or equitably deriving any estate, right, title or interest of, in or to the property hereby sold, assigned and transferred, that it shall and will at any time or from time to time hereafter, upon request of said Minerals Separation North American Corporation, its successors or assigns, make, do, execute, acknowledge or deliver, or cause to be made, done, executed, acknowledged or delivered, all and every such

P. 5474, L. 27, after "assigns" insert "but at the cost and expense of said Minerals Separation North American Corporation, its successors or assigns,"

Plaintiffs' Exhibit No. 289

further and other lawful acts, deeds, bills of sale, transfers, assignments and assurances in the law, whether in the United States of America, Kingdom of Great Britain or any other country, for the better and more effectual vesting and confirming the property hereby bargained, sold, assigned, transferred and set over, or so intended to be, in and to said Minerals Separation North American Corporation, its successors and assigns forever, as by said Minerals Separation North American Corporation, its successors or assigns, or its or their counsel learned in the law shall be reasonably advised or required.

Annexed hereto, marked "A" and made part hereof, is a partial list of the patents and applications either owned by the Minerals Separation American Syndicate, (1913), Limited, the vendor corporation, or in or to which it has any right, title or interest, and which is part of the property hereby transferred or intended so to be.

Annexed hereto and made part hereof and marked "B" is a partial list of the licenses granted in respect of the

Page 4

patents either owned by the Minerals Separation American Syndicate (1913), Limited, the vendor corporation, or in which patents it has any right, title or interest.

IN WITNESS WHEREOF, MINERALS SEPARATION AMERICAN SYNDICATE (1913), LIM-

ITED, has caused its name to be hereto affixed by John Ballot, its duly constituted Attorney in Fact, under and by virtue of a Power of Attorney dated October 11, 1916.

Minerals Separation American Syndicate (1913) Limited.

by John Ballott

Its Attorney in Fact.

STATE OF MARYLAND,
CITY OF BALTIMORE—ss.

ON DECEMBER 7th, 1916 before me personally came JOHN BALLOT, the Attorney-in-Fact of Minerals Separation American Syndicate (1913), Limited, a Company organized under the laws of Great Britain, to me personally known and known to me to be the individual described in and who as such Attorney executed the within instrument and acknowledged that he executed the same as the act and deed of Minerals Separation American Syndicate (1913), Limited therein described by virtue of a Power of Attorney duly executed by said Minerals Separation American Syndicate (1913) Limited, bearing date October 11, 1916, which Power of Attorney was exhibited to me.

Emma L. Burke

(Seal) Notary Public.

Plaintiffs' Exhibit No. 289

Page 5.

PATENTS GRANTED IN RESPECT OF THE UNITED STATES OF AMERICA.

No.	
763259	Classifier
763260	Separator and Classifier
763749	Separation of Minerals
776145	Potter
777273	Separator
777274	Soap and Granulation
784999	Separating and Concentrating
788247	Soap and Flotation
793808	Air bubbles
809959	Kirby Separator
835120	Oleic Acid Froth
835143	Boiling
835479	Super-Aerator
838626	Kirby Separator
864597	De Bavay
879985	Table Flotation
902018	Buddle
912783	De Bavay
953746	Froth Apparatus with Baffle
955012	Alcohol
962678	Solution
979857	Frothing Apparatus Agitator as Pump
1045970	T. J. Greenway
1064209	Staggered Spitz

Plaintiffs' Exhibit No. 289

1064723	Essential Oils
1067485	Fractional Flotation
1070784	Controlling the Flow of thick pulpy material
1079107	Sodium Bisulphate
1084196	Open Spitz
1084210	Agitator
1093463	Froth Trap
1099699	Copper Ores without Acid
1101506	Bradford
1102873	Doctored Water
1102738	Bi-chromate

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PATENTS GRANTED IN RESPECT OF THE UNITED STATES OF AMERICA.

No.	
1102874	Modifying during Grinding
1142821	Alkali & Bi-chromate
1142822	Littleford
1155815	Sub-Aerator
1155816	Sub-Aeration Apparatus
1155836	Owen's Apparatus
1155861	Bubble Separation without oil
1170665	Acid Sludge
1170637	Sulphuric Acid Compounds
1157176	Owens Permanganate

Plaintiffs' Exhibit No. 289

APPLICATIONS.

Ser. No.	
262890	Air Flotation without oil (abandoned)
No.	
76634 6	Metallic Sulphides
793270	Steam Spray
800966	Ferric Chloride
808986	Copper Precipitant
824765	Alkaline Float
831939	Flotation Process by Sub-Aeration
835812	Owen's Selective Flotation
843304	Sodium Carbonate
845086	Copper Precipitant
Ser No.	
858737	Insufficient Acid
No.	
858738	Insufficient Frothing Agent
863097	Classifying
863098	Sizing
864230	Argol
872470	Aqueous Extract of Oil
14015	Electrical Relations (1)
20815	Hebbard's Coke
27098	Concentrated Alkali
34644	Electrical Relations (2)
37350	Seale & Shealshear
39927	Metallic Sulphides
40847	Bleaching Powder
766346	Metallic Sulphides

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APPLICATIONS.

Ser No. 74921		Martin's Inventions
" 74922		Martin's Inventions
" 91873		Horizontal Agitator
" 94339		Caustic Alkalis
" 105916		
Divisional from Ser. No. 14015 Ser. No. 108208 Ser. No. 108209		Electrical Relations (1)
Divisionals from Ser. No. 766346		Metallic Sulphides
Divisional from Ser. No. 824765		Alkaline Float

PATENTS GRANTED IN RESPECT OF THE DOMINION OF CANADA

No.	
76621	Potter
87700	Air Bubbles
87785	Separator
87786	Classifier
94332	Di-electric Separator (Abandoned)

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94516	Soap
94718	Concentrating Table
86182	Oleic Acid Froth
96183	Air Flotation
99743	Super-Aerator
121676	Potter's S. O. T. Limited (Abandoned)
127397	Solution
129819	Froth Apparatus with Baffle
129820	Agitator as Pump
134271	Essential Oils
135089	Livening Oxidised Ores
137404	Fractional Flotation
142607	Copper Ores without Acid

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PATENTS GRANTED IN RESPECT OF THE DOMINION OF CANADA.

No.	
147431	Sodium Bisulphate
147432	Agitator
148275	Froth Trap
151479	Open Spitz
151480	Bi-chromate
151619	Bradford
151810	Steam Spray
157488	Modifying during Grinding
157603	Metallic Sulphides
157604	Copper Precipitant
160692	Staggered Spitz

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160693	Ferric Chloride
160694	Sub-Aerator
160846	Alkali & Bi-chromate
160847	Sodium Carbonate
160848	Insufficient Frothing Agent
160849	Insufficient Acid
160850	Alkaline Float
163608	Doctored Water
163707	Hebbards Coke
164587	Bubble Separation Without Oil
165390	Bleaching Powder
163936	Owen's Selective Flotation
166415	Electrical Relations (1)
167474	Sulphuric Acid Compounds
167603	Acid Sludge
167475	Concentrated Alkali
167476	Seale & Shellshear
160937	Owen's Permanganate
151810	Steam Spray
157604	Copper Precipitant
163936	Owen's Selective Flotation

APPLICATIONS

Ser. No. 202962	Caustic Alkalis
" " 204309	Soap Froth

Plaintiffs' Exhibit No. 289

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ATENTS GRANTED IN RESPECT of ~~TO~~ THE REPUBLIC OF MEXICO

No.	
3276	Air Bubbles
3397	Separator & Classifier
3605	Potter
3642	Soap
4267	Amalgamation Agreement
4268	"
4269	"
4622	Di-Electric Separator
4635	Concentrating Table
(4907	Oleic Acid Froth
Re-issue (5561	"
(4908	Air Flotation
Re-issue (5560	"
5602	Super-Aerator
5603	Cylinder & Selective Flotation
9362	Potter's S. O. T., Ltd.
9422	Solution
9592	Froth Apparatus with Baffle
11087	Essential Oils
11943	Livening Oxidised Ores
11989	Frothing apparatus Agitator as Pump
12050	Copper Ores without Acid
12290	Froth Trap
12291	Fractional Flotation

Plaintiffs' Exhibit No. 289

12781	Potter's S. O. T., Ltd.
13316	Sodium Bisulphate
13749	Howard's Agitator
13820	Doctored Water
13991	Staggered Spitz
14196	Bi-chromate
14208	Metallic Sulphides
14344	Open Spitz
14537	Modifying during grinding
14696	Steam Spray
14749	Ferric Chloride
14833	Sub-Aerator
14862	Copper Precipitant
14980	Owen's Selective Flotation

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PATENTS GRANTED IN RESPECT OF THE REPUBLIC OF MEXICO

No.	
15030	Alkaline Float
15160	Alkaline & Bi-chromate
15223	Insufficient Acid
15277	Insufficient Frothing Agent
15292	Sodium Carbonate
15513	Bubble Separation without Oil
15523	Sulphuric Acid Compounds
15524	Acid Sludge
15549 bis	Electrical Relations
15598	Hebbard's Coke
15656	Concentrated Alkali

Plaintiffs' Exhibit No. 289

15618	Bleaching Powder
15625	Seale & Shellshear
15029	Owen's Permanganate
14537	Modifying during Grinding
14696	Steam Spray
14749	Ferric Chloride
14833	Sub-Aerator
14862	Copper Precipitant
15160	Alkali & Bi-chromate
15223	Insufficient Acid
15549 bis	Electrical Relations (1)
15656	Concentrated Alkalis
16003	Caustic Alkalis

PATENTS GRANTED IN RESPECT OF THE REPUBLIC OF CUBA

No.	
1520	Frothing Apparatus Agitator as Pump
1521	Alcohol & Solution
1946	Doctored Water
1976	Modifying during grinding
2116	Copper Precipitant

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B.

Various Licenses Granted.

Name of Licensee.	Date of License.
Cuba Copper Co.	25th June 1912
Britannia Mining & Smelting Co.	19th November 19
Silverton Mines	16th January 1913
Ducktown Sulphur, Copper & Iron Co.	27th February 191
Inspiration Copper Co.	10th April 1913
Colusa Parrot Mining & Smelting Co.	7th May 1913
Elm Orlu Mining Co.	7th May 1913
Wm. MacDonald & Louis S. Noble	13th May 1913
Atlas Mining & Milling Co.	22nd May 1913
Consolidated Arizona Smelting Co.	19th September 19
Old Dominion Copper Mining & Smelting Co.	26th September 191
M. W. Atwater	6th February 191
Flint Mines Ltd.	16th February 1914
Mountain Copper Co.	11th March 1914
Mond Nickel Co., Ltd.	30th April 1914
Mineral Recovery Co.	19th May 1914
Phelps, Dodge & Co.	11th June 1914
Engels Copper Mining Co.	18th June 1914
Standard Silver Lead Mining Co.	24th June 1914
Cusi Mining Co.	22nd January 1915
Anaconda Copper Mining Co.	1st February 1915
Weedon Mining Co.	3rd June 1915
Arizona Copper Co., Ltd. (Registered in England)	11th June 1915
St. Joseph Lead Co.	16th August 1915
Doe Run Lead Co.	16th August 1915
Utah Leasing Co.	24th August 1915
Portland Gold Mining Co.	29th November 191
Chichagoff Mining Co.	29th November 191
Desloge Consolidated Lead Co.	1st January 1916
Sociedad Anonima des Metals, Brockmann & Co., Inc.	March 1916
Broadwater Mills Co.	14th March 1916

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ame of Licensee.	Date of License.
ona Copper Co. (Regd. Clifton eenles Co. Arizona)	21st March 1916
ne Cananea Copper Co.	12th May 1916
icator Consolidated Gold Mining Co.	26th June 1916
iam Kent.	1st July 1916
hland Valley Mining & Develop. Co. P. L.	10th August 1916
on Co.	15th August 1916

Filed May 18, 1917.

GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Plaintiffs' Exhibit No. 290.

Tons of Flot. Hds. Cu Assay lbs. Cu in Head

9794 × .0777 × 2000 = 1,521,988

Tons of Flot. Conc. lbs Cu in Conc.

2884 × .2603 × 2000. = 1,501,410

$\frac{1,501,410}{1,521,988} \times 100 = 98.65$

Recovery expressed in % = 98.65

9794 − 2884 = 6910 Tons of Tailing

1,521,988 − 1,501,410 = 20,578 lbs. Cu in Tails

20,578 ÷ 6910 ÷ 20 = .149 % Cu in Tails

20,578 ÷ 9794 = 2.10 lbs. of Cu in Tailing per ton of Heading

2.1 lbs. of Cu at

Filed August 23, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Plaintiffs' Exhibit No. 291.

Date: June 24th, 1914.

Parties: Standard Silver-Lead Mining Company, A Washington State Corporation, with place of business at Spokane, Wash.

Mines and Mills at Silverton in the Province of British Columbia, Canada.

Royalty Clause:

The Licensees shall pay to the Licensors a royalty on the total mineral products recovered in all concentrates produced One and 25/100 ($1.25 dollars per ton of two thousand (2,000) pounds of zinc concentrates net dry weight; such royalty to be payable for the entire period during which concentrates are produced. (Balance the same as in printed form)

Payments: London

Staff Members: One at £60 per month.

Contract: England

Signatories:

Standard Silver-Lead Mining Co.,

By W. J. C. Wanifuid,

Attest: As its President

Charles Hussey, as its Secretary

For Minerals Separation, Ltd.,

John Ballot, } Directors
T. Herbert Curle }

A. O. Williams, Secretary.

English acknowledgement: August 28th, 1914.

American acknowledgement: July 7th, 1914.

(New Form)

Plaintiffs' Exhibit No. 291

ABSTRACT

Date: February .... 1914.

Parties: The Flint Mines Limited, a New York corporation, having office at 43 Wall Street, New York, with Mines and Mills situated in the Owyhee County in the State of Idaho.

Royalty Clause:

The Licensees shall pay to the Licensors a royalty at the rate of 2½% (two and one half per cent) of the value of the Silver, less five ounces, and 2½% (two and one half per cent) of the value of any Antimony paid for less eight unites and 25 (twenty five) cents per ounce of saleable gold contained in the (balance of clause as in printed form.)

Payments: London or New York

Staff Members: One at £60 per month.

Contract: New York Contract

Signatories:

The Flint Mines Limited.

By Hugh Morgan, Jr., Secretary.

Attest: Hugh Morgan, Jr., Secy.

For Minerals Separation, Ltd.,

John Ballot,
H. A. Krohn, } Directors.

A. O. Williams, Secretary.

English acknowledgement: February 16th, 1914.

American acknowledgement: March 3rd, 1914.

(New Form)

Plaintiffs' Exhibit No. 291

ABSTRACT

Date: May 19th, 1914.

Mineral Recovery Company a Missouri corporation, having its place of business at Joplin, Missouri, with Mines and Mills located at Joplin, Missouri.

License to treat slime and sand tailings of the Prescilla Mine of Underwriters' Land Company, Joplin, Missouri.

Royalty Clause:

The Licensees shall pay to the Licensors a royalty on the total mineral products recovered in all concentrates produced from said tailings, as follows: One Dollar and Twenty-five Cents ($1.25) for each ton of two thousand (2,000) pounds dry weight of zinc concentrates; such royalty to be payable for the entire period during which concentrates are produced from said tailings . . . . . .by the use, etc., as in written form (Balance same).

Payment: London;

Staff Members: One at salary of £60 per month.

Contract: To be construed as New York contract.

Signatories:

Mineral Recovery Co.,
By Geo. S. Thomas, Pres.

Attest: D. I. Hayes.
D. I. Hayes.

For Minerals Separation, Limited.
John Ballott
W. W. Webster Directors
A. O. Williams, Secretary

Plaintiffs' Exhibit No. 291

English Acknowledgement of date May 29, 1914.
American Acknowledgement, of date May 2nd, 1914.
New Form

ABSTRACT

Date: June 14th, 1914.

Engels Copper Mining Company, No. 393 Mills Building, San Francisco, California.

Operations in Plumas County, Califorina, known as Engels Mines.

Royalty Clause:

The Licensees shall pay to the Licensors a royalty on the total amount of ore milled at the rate of twelve cents for each short ton (2,000) lbs. (dry weight) of crude ore milled when said ore contains not more than two and one-half per cent. (2½%) of copper; and fifteen cents for each such short ton of crude ore milled when said ore contains more than two and one-half per cent. (2½%) of copper; such royalty to be payable for the entire period during which ~~he~~ concentrates are produced from the ore of said mines by the use of any of the said inventions improvements additions and discoveries, (Balance as in printed form)

Payments: London or New York

Staff Members:: One or more at £60 per month

Contract: To be construed as New York contract

Signatories:

Engels Copper Mining Company
By Henry Engels, its President
Elmer E. Ganton, its Treasurer

Attest Landon A. Bell, Secretary

Plaintiffs' Exhibit No. 291

For Minerals Separation, Ltd.

W. W. Webster Directors

H. A. Krohn

A. O. Williams, Secretary.

English acknowledgement, June 18, 1914.

American Acknowledgement June 3, 1914.

Attached, Letter of June 23rd, 1914. (See copy)

New Form

COPY

London, June 23rd, 1914.

Engels Copper Mining Company,

San Francisco, Calif.

Dear Sirs:

Referring to the license agreement between our Company, Minerals Separation, Limited, and you, we hereby consent—

1st. That the closing sentence of paragraph 3 of said license, reading as follows; "The Licensee shall not, without the consent of the Licensors during the continuance of this license, use of employ any improvement, modification, or addition to any of the inventions specified in the Letters Patent within this license, which said improvement, modification or addition is not the property of the Licensors", shall not preclude the Licensee from using at any time during the term of the license any smelting, leaching or other process for extracting ores which is not essentially a flotation process or an oil concentration process and which does not infringe any of the patents under which said license is granted.

Plaintiffs' Exhibit No. 291

2nd. That we hereby guarantee to the Engels Copper Mining Company that, should we make any change in our basis of computing royalties tending to reduce the same, or make any general royalty reductions, that you shall have the benefit of such reductions in so far as they may apply to the ores produced at your mines;

3rd. It is understood that we will make no objection at any time to your shipping direct and without the payment of any royalty to us such high grade ores as you may desire to ship without treatment by any of our processes.

Very truly yours,

(Sgd) W. W. Webster
H. A. Krohn, Directors
A. O. Williams, Secretary

(Seal)
(M. S. Ltd.)

ABSTRACT

Date: February 6th, 1914.

Maxwell W. Atwater, of Butte, Silver Bow County, Montana.

Dumps and mills at Basin, Jefferson County, Montana.

Location: In or near Basin, Jefferson County, Montana. Known as the zinc Tailings Dumps on the property owned or controlled by the Licensee at Basin, Montana.

Royalty Clause:

The licensee shall pay to the licensors a royalty on

Plaintiffs' Exhibit No. 291

the total mineral products recovered in all concentrates produced from said tailings dumps as follows: One and 25/100 ($1.25) Dollars per ton of two thousand (2,000) pounds of zinc concentrates net dry weight; such royalty to be payable for the entire period during which concentrates are produced from said tailings dumps, by the use of any of the said inventions improvements additions and discoveries. (Balance as printed in later form)

Payments: At London or New York

Staff Member: To be furnished at £60 per month

Contract: To be construed as New York contract

Signatories:

John Ballot) Directors
H. A. Krohn)

A. O. Williams, Secretary

M. W. Atwater

English acknowledgement of date March 2, 1914

American acknowledgement of date February 6th, 1914.

New Form

Plaintiffs' Exhibit No. 291

ABSTRACT

Date: May 13th, 1913

Parties: Mineral Separation Limited and WILLIAM B. McDONALD of Leadville, Colorado (Box 566) and LOUIS S. NOBLE of 932 Equitable Building, Denver, Colorado.

Property: The Page-Harrigan Dumps (estimated fourteen thousand tons) located in Stray Horse Gulch; the Resurrection Dump (estimated thirty thousand ton) located at Little Ellen Hills and the ore now developed (estimated twenty five thousand tons) in Resurrection Mine Leadville, Colorado, and for no other purpose.

Royalty Clause:

The Licensees shall pay to the Licensors a royalty at the rate of two (2) cents per unit for each unit of zinc contained in said concentrates in excess of eight (8) units a unit being twenty (20) pounds in each ton of two thousand (2,000) pounds of dry weight of concentrates and at the same rate two (2) cents per unit for each such unit of lead contained in said concentrates in excess of eight (8) such units and also two and one half per centum (2½%) of the value of all other products contained in said concentrates as paid for by the smelter on concentrates produced by the use of any of the inventions specified in the said Let-

Plaintiffs' Exhibit No. 291

ters Patent or by the use of any improvements or modifications thereof, or additions thereto, or any new patents granted in connection therewith.

Payments: New York and London

Staff Member: $250.00 per month for six months.

Contract: Under the laws of England.

Signatories:

For the Minerals Separation,

John Ballot,

T. Herbert Curle. Directors.

A. O. Williams Secretary.

Wm. B. McDonald, and

Louis S. Noble

Witnesses: Harold C. Hankins,

William J. Walton.

Old Form

ABSTRACT

Date: February 27th, 1913.

The Ducktown Sulphur Copper and Iron Company ~~ore now developed (estimated twenty-five thousand~~ Limited, No. 1 Gresham House, Old Broad Street, London.

Property in the State of Tennessee, U. S. A. only.

Royalty Clause:

The Licensee shall pay to the Licensors ro~~lay~~yalties at the following rates namely:—Six cents per twenty pounds copper in concentrates produced—two and a half per cent value of saleable silver in concentrates in concentrates produced and twenty five cents per ounce of saleable gold of concentrates produced with a minimum in any case of twelve cents per ton of ore treated by and with the use of any of the inventions specified in the said Letters Patent or by or with the use of any improvements or modifications thereof or additions thereto or any new patents granted in connection therewith.

Payments: London

Staff Member: £60 per month, six months.

Contract under laws of England

Signatories:

For Minerals Separation

John Ballot

Francis L. Gibbs, Directors

A. O. Williams, Secretary

DUCKTOWN SULPHUR COPPER AND IRON COMPANY LIMITED

Lewis S. Mortimer

Edward Derby Directors

W. Berny, Secretary

Old Form

ABSTRACT

Date: March 11th, 1914.

Parties: Minerals Separation Limited and The Mountain Copper Company Limited, whose registered office is situated at 3 Lombard Street London, E. C. (hereinafter called "the Licensees") of the other part.

Plaintiffs' Exhibit No. 291

Property situate in Shasta County, California, known as the Iron Mountain Mines, but not elsewhere.

Royalty Clause:

The licensees shall pay to the Licensors a royalty on the total amount of ore milled at the rate of Twelve cents for each short ton (Two thousand pounds dry weight) of crude ore milled when said ore contains less than two per cent (2%) of copper and fifteen cents for each such short ton of crude ore milled when said ore contains two per cent (2%) or more of copper; such royalty to be payable for the entire period during which concentrates are produced from the ore of the said mines by the use of any of the inventions specified in the said Letters Patent or by the use of any improvements or modifications thereof or additions thereto or any new patents granted in connection therewith. (Balance the same as printed form)

Payments: London or New York

Staff Members: One at rate of £60 per month.

Contract: English contract.

Signatories.

The Mountain Copper Company Limited,

N. M. MacDonald, Director.

A. N. Freuer, Secretary.

For Minerals Separation, Ltd.,

John Ballot,

Francis L. Gibbs, Directors.

A. O. Williams, Secretary

(Old Form)

Plaintiffs' Exhibit No. 291

ABSTRACT

Date: May 22nd, 1913.

Parties: The Atlas Mining & Milling Company, a Colorado corporation, with registered office at Ouray, Colorado.

Operations in State of Colorado, at Atlas Mines.

Royalty Clause:

The Licensees shall pay to the Licensors a royalty on the total mineral products recovered in all concentrates or bullion produced from the ore of said mines as follows: Two and one half (2½%) per cent of the value of the silver in said concentrates or bullion as paid for by the smelters ~~or in said concentrates or bullion as paid for by the smelters~~ or mint; twenty five (25) cents per ounce for all gold contained in said concentrates or bullion; two (2c) cents per unit for each unit of lead contained in said concentrates in excess of eight units, a unit being twenty pounds in each ton of two thousand pounds dry weight of concentrates; six (6c) cents per unit for each such unit of copper contained in said concentrates, if paid for by the smelter; two (2c) cents per unit for each such unit of zinc contained in said concentrates in excess of eight units, if paid for by the smelter; provided, however, that such payment on concentrates or bullion produced shall not be less than twenty five (25c) cents for each short ton (2000) dry weight, of crude ore produced from said mine such royalty to be payable

P. 5501, L. 3, after "any" insert "of the inventions specified in the said letters patent, by the use of any"

P. 5501, L. 22, insert:

"For Minerals Separation, Ltd.,
John Ballot,
Francis L. Gibbs, Directors.
A. O. Williams, Secretary."

y:
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Plaintiffs' Exhibit No. 291

for the entire period during which concentrates are produced from the ore of said mines by the use of any of the improvements or modifications thereof or additions thereto, or any new patents granted in connection therewith, provided, however, that in computing said royalty and minimum all ore or said mines which has not been treated or a part or parts or product or products whereof has or have not been treated by the use of any of said inventions shall be excluded from computation. (Balance as in Printed form)

Payments: London or New York

Staff Members: One or more at £50 per month

Contract: Shall be construed as English Contract

Signatories:

(Name of Atlas Mining & Milling Company not affixed)

Wm. Hore, Jr.,

W. D. Shipman, Directors,

C. H. Wagner, Vice President,

Fred Carroll, Secretary.

Attached letter in remodification of terms of royalty. (Old Form)

Plaintiffs' Exhibit No. 291

(COPY)

ATLAS MINING & MILLING COMPANY

In letter from Mr. Nutter to the Atlas Mining & Milling Co. of February 10th 1915, he states that Mr. Ballot and Dr. Gregory had agreed and were willing to meet the company as far as possible in the matter of a modification of the terms of the royalty arrangement, and proposed to waive as from January 1st, 1915, the minimum rate of 25c per ton of material treated by the Atlas Co. From that date they will merely pay the unitage royalty on all metal values recovered as per clause 1 of the License, with no fixed minimum per ton of ore treated.

ABSTRACT

Date : May 7th, 1913.

Colusa-Parrot Mining and Smelting Company, (a Washington Corporation) of Butte, Montana.

The Old dump hereinafter described.

The old dump at the Butte Reduction Works, near Butte, Montana, and for no other purpose.

Royalty Clause:

The Licensees shall pay to the Licensors a royalty on the total mineral products in all concentrates produced from said tailings as follows: Six cents per unit for each unit of copper contained in said concentrates, a unit being twenty pounds in each ton of two thousand pounds dry weight of concentrates; and two and one half per cent of the value of all silver and

Plaintiffs' Exhibit No. 291

gold, or either silver or gold in said concentrates as paid for by the smelter; such royalty to be payable for the entire period during which concentrates are produced from the said tailings or products thereof by the use of any of the inventions specified in the said Letters Patent or by the use of any improvements or modifications thereof or additions thereto, or any new patents granted in connection therewith.

Payments: London or New York.

Staff Member: For six months at £60 per month.

Contract under Laws of England.

Signatories:

For Minerals Separation

John Ballot, Director

For Colusa-Parrot

M. C. Messias, Secretary.

Ratified by Colusa Parrott Mining & Smelting Company at a special meeting of the Board of Directors, of date May, 29th, 1913.

(Old Form)

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ABSTRACT

Date: May 7th 1913.

The Elm Orlu Mining Company (a Washington corporation) of Butte, Montana.

The State of Montana, property known as the Elm Orlu Mines.

Use in the Butte District, State of Montana.

Royalty Clause:

The Licensees shall pay to the Licensors a royalty on the mineral products recovered in all concentrates produced from the ore of said Mines, as follows:—two cents per unit for each unit of zinc contained in said concentrates in excess of eight units, a unit being twenty pounds in each ton of two thousand pounds dry weight of concentrates, six cents per unit for each unit of copper contained in said concentrates; two and one-half per cent. of the value of the silver in said concentrates as paid for by the smelter; and twenty five cents per ounce for all gold contained in said concentrates; or, at the option of the Licensee to be exercised within sixty (60) days from the day and year first above written, in place of the royalty as above set forth computed on the total mineral products recovered in all of the concentrates, a royalty at the rate of fifty cents per ton of two thousand pounds dry weight of all crude ore produced from said mines; such royalty to be payable for the entire period during which concentrates are produced from the ore of said mines by the use of any of the inventions specified in the said Letters Patent or by the use of any improvements

Plaintiffs' Exhibit No. 291

or modifications thereof or additions thereto, or any new patents granted in connection therewith.

Payments: London or New York

Staff Members: One or more at £60 per month for six months.

Contract under laws of England.

Signatories:

For Minerals Separation

John Ballot

H. A. Krohn Directors

A. O. Williams, Secretary

Elm Orlu Mining Company

by (sd) W. A. Clark, Vice President

W. D. Mangam, Secretary

Contract ratified by special meeting of Board of Directors of the ELM ORLU MINING COMPANY, of date May 29th, 1913.

(Old Form)

ABSTRACT

Date: September 19th, 1913.

Consolidated Arizona Smelting Company, New York, N. Y.

Property, at Humboldt, Arizona, known as the Humboldt Smelter, and its Mines in Mayer, Arizona, known as the Blue Bell Mine and De Soto Mine.

Said Property and mines, only.

Royalty Clause:

The Licensee shall pay to the Licensors a royalty at

Plaintiffs' Exhibit No. 291.

the rate of Six cents for each unit of copper in the concentrates, a unit of copper being twenty pounds per short ton (2,000 lbs. dry weight) of the concentrates; two and one half per cent of the value of the silver in said concentrates as paid for by the smelter; twenty five cents per ounce for all gold contained in said concentrates as paid for by the smelter; provided, however, that such payment shall not be less than twelve cents for each short ton (2,000 lbs., dry weight) of crude ore milled; and provided further, that for all concentrates produced from old tailings the royalty shall be as above stated except that the provision for the minimum rate of such payment shall not be applicable; such royalty to be paid for concentrates produced by the use of any inventions specified in said Letters Patent or by the use of any improvements or modifications thereof or additions thereto or any new patents granted in connection therewith.

Payments: London or New York

Staff Member: At £60 per month

Contract: Under the laws of England.

Signatories:

For Minerals Separation

John Ballot

W. A. Krohn Directors

Consolidated Arizona Smelting Company,

Victor T. Ammons, President

Fred W. Thompson, Secretary

(Old Form)

P. 5507, L. 9, after " copper " insert " in the concentrates, a unit of copper "

Plaintiffs' Exhibit No. 291

ABSTRACT

Date: September 26th, 1913

Parties: Old Dominion Copper Mining & Smelting Company, with office situate at Boston, Mass.

Operations at Globe, Arizona

Royalty Clause:

The Licensees shall pay to the Licensors a royalty at the rate of six cents for each unit of copper, being twenty pounds per short ton (2,000 lbs. dry weight) of the concentrates; two and one half per cent of the value of the silver in said concentrates as paid for by the smelter; twenty five cents per ounce for all gold contained in said concentrates as paid for by the smelter; provided, however, that such payment shall not be less than twelve cents for each short ton (2,000 lbs. dry weight) of crude ore milled; such royalty to be paid for (Balance same as in printed form.)

Payments: London or New York

Staff Members: One at £50 per month

Contract: As made in England.

Signatories:

For Minerals Separation, Ltd.,

John Ballot, H. A. Krohn, } Directors

A. O. Williams, Secretary

Old Dominion Copper Mining & Smelting Co.,

Charles S. Smith, President.

Charles H. Altmill, Secretary.

(Old Form)

See attached letters in re cancellation, of date, June 18, 1914, and July 1st, 1914.

Plaintiffs' Exhibit No. 291

OLD DOMINION COPPER MINING &
SMELTING CO.,
50 Congress Street,
Boston,

June 18, 1914.

Charles S. Smith, President
Charles H. Altmiller, Secy. & Treas.
Telephone Main 6552

Minerals Separation, "Limited,"
62 London Wall,
London, E. C., England.

Gentlemen:

The Old Dominion Copper Mining & Smeltering Company, a party to the license agreement between the Minerals Separation, "Limited," (called the Licensors) and the Old Dominion Copper Mining & Smelting Company, (called the Licensees), dated September 26, 1913, hereby notify said Licensors that the Licensees renounce and abandon said license and all rights thereunder; that they refuse to act further under the same and to pay further royalties in connection therewith.

Yours very truly,
CHARLES S. SMITH,
President.

Plaintiffs' Exhibit No. 291

COPY.

REGISTERED: 1st July 1914

M. E. P.

J. B.

Messrs. The Old Dominion Copper Mining & Smelting Co.,

Mr. Charles S. Smith, President,

50 Congress Street,

Boston.

Gentlemen:

I beg to acknowledge receipt of your letter of the 18th June in which you assume to renounce and abandon the license agreement dated the 26th September 1913, between my Company and the Old Dominion Copper Mining and Smelting Co., and in which you notify us of your refusal to act further under the same and to pay further royalties in connection therewith, and I am instructed by my Board to inform you that they have carefully considered the whole matter.

My Board desire to know whether they are right in assuming that you do not intend in the future to use any of my Company's patented inventions.

If you had so intended we agree of course that you are entitled under the License at any time to discontinue the use of our inventions.

But it must be obvious to you that you are not under any circumstances entitled to renounce and abandon the license agreement and should that have been your intention, my Board hereby notify you that they refuse to accept such renunciation and abandonment.

My Board desire to point out that they have in all respects and in all good faith strictly observed the terms and conditions of the agreement, and will continue to do so, and in the same way they expect you to observe the terms and conditions on your part.

I remain, Gentlemen,

Yours faithfully,

(Sgd) A. O. Williams,

Secretary.

By Order of the Board.

ABSTRACT

Date: April 10th, 1913

Inspiration Consolidated Copper Company, 42 Broadway, New York.

Inspiration Mines, State of Arizona, U. S. A.

Treatment of products of said mines in State of Arizona.

Royalty Clause:

The Licensees shall pay to the Licensors a royalty at the rate of twelve cents (12c) for each short ton (2,000 pounds dry weight) of ore treated on all tonnages up to and including four thousand (4,000) of such tons per day; at the rate of ten cents (10c) for each such ton of ore treated on all total tonnages of more than four thousand (4,000) and up to and including six thousand (6,000) of such tons per day;

Plaintiffs' Exhibit No. 291

and at the rate of nine (9c) cents for each such ton of ore treated on all total tonnages of more than six thousand (6,000) of such tons per day; such royalty to be computed as of the average treatment for each day in the period of three months preceding a quarter day and to be paid in lawful money of the United States on all ore treated by the use of any of the inventions specified in the said Letters Patent or by the use of any improvements or modifications thereof or additions thereto, or any new patents granted in connection therewith.

Payments: London or New York

Staff Member: One or more to be furnished at £60 per month.

Signatories:

John Ballot, Francis L. Gibbs, } Directors

A. O. Williams, Secretary

For Inspiration Consolidated Copper Co.

W. D. Thornton, Vice President

J. W. Allen Secretary

Contract ratified by resolution of Board of Directors of Inspiration Consolidated Copper Co. of date March 27, 1913.

(Old Form)

Plaintiffs' Exhibit No. 291

ABSTRACT

Date: September 16th, 1913.

Phelps, Dodge & Company, New York, N. Y.

Burro Mountain Copper Company

Treatment of products of said mine.

Royalty Clause:

The Licensees shall pay to the Licensors a royalty at the rate of six cents for each unit of copper in the concentrates, a unit of copper being twenty pounds per short ton (2,000 lbs. dry weight) of the concentrates; two and one-half per cent of the value of the silver in said concentrates as paid for by the smelter; twenty five cents per ounce for all gold contained in said concentrates as paid for by the smelter; provided, however, that such payment shall not be less than twelve cents for each short ton (2,000 lbs. dry weight) of crude ore milled; such royalty to be paid for concentrates produced by the use of any of the inventions specified in the said Letters Patent or by the use of any improvements or modifications thereof or additions thereto, or any new patents granted in connection therewith.

Payments: London or New York.

Staff Member: To be furnished at £50 per month & expenses.

Signatories:

For Minerals Separation, Limited:

John Ballot,
W. A. Krohn, Directors
A. O. Williams, Secretary

Plaintiffs' Exhibit No. 291

For Phelps, Dodge & Company,
James Douglas
Cleveland H. Dodge Directors
F. T. Bulmer, Asst. Secretary.

(Old Form)

See copies of attached letters re cancellation of contract.

COPY

PHELPS, DODGE & CO.
Incorporated

99 John Street,
Corner Cliff St.,
New York, June 11th, 1914.

Minerals Separation, Limited,
62 London Wall,
London, E. C., England.

Dear Sirs:

Phelps, Dodge & Co., a party to the license agreement between Minerals Separation, Limited (called the Licensors) and Phelps, Dodge & Co. (called the Licensees) dated September 15th, 1913, hereby notify said licensors that the licensees renounce and abandon said license and all rights thereunder; that they refuse to act further under the same and to pay further royalties in connection therewith.

Yours truly,

PHELPS, DODGE & CO.
Gerry Nortman
Secretary.

GNW

Plaintiffs' Exhibit No. 291

COPY

PHELPS, DODGE & CO.
99 John Street, New York,

June 11th, 1914.

Messrs. Beer, Sondheimer & Company,
61 Broadway, City.

Dear Sirs:

Herewith we beg to enclose copy of a letter which we are mailing to-day to the Minerals Separation, Limited, 62 London Wall, London, E. C., England.

Yours very truly,

PHELPS, DODGE & CO.

(sd) George Notman

Secretary

Copy of preceding letter attached.

Plaintiffs' Exhibit No. 291

COPY

MINERALS SEPARATION AMERICAN SYNDICATE, (1913), LTD.

S S Oceanic

New York, June 12th, 1914.

Messrs. Minerals Separation, Limited,
62 London Wall, E. C.

Dear Sirs:

Re: MESSRS. PHELPS, DODGE & COMPANY

Messrs. Beer, Sondheimer & Company to-day received a letter with enclosure, as per copy herewith. I think it will be best simply to acknowledge receipt and say the matter will be submitted to the Board at its next meeting as soon as the Chairman returns to London. I will be in a better position to explain to the Board on my arrival what has been done here, and what should be done in London.

Yours truly,

encl. (SD) John Ballot.

COPY

S S OCEANIC

24th June, 1914.

Messrs. Phelps, Dodge & Company, Inc.,
99 John Street,
Corner Cliff Street,
NEW YORK, U. S. A.

Dear Sirs:

We have to acknowledge due receipt of your letter of 11th June, received under registered cover, which will be submitted to our Board of Directors at its next meeting, as soon as our Chairman returns to London.

We, are, dear Sirs,

Yours truly,

(SGD) A. O. Williams,

Secretary.

COPY

REGISTERED

S S OLYMPIC 1st July, 1914.

Messrs. Phelps, Dodge & Co.,

Mr. George Notman—Secretary,

99 John Street,

NEW YORK, U. S. A.

Gentlemen:

Referring to our previous letter to you of the 24th ultimo, and in further reply to yours of the 11th ultimo in which you assume to renounce and abandon the license agreement dated the 16th September, 1913, between my Company and Messrs. Phelps, Dodge & Co. and in which you notify us of your refusal to act further under the same and to pay further royalties in connection therewith, I am now instructed by my Board to inform you that they have carefully considered the whole matter.

My Board desire to know whether they are right in

Plaintiffs' Exhibit No. 291

assuming that you do not intend, in the future, to use any of my Company's patented inventions.

If you had so intended we agree, of course, that you are entitled under the license at any time to discontinue the use of our inventions.

But it must be obvious to you that you are not under any circumstances entitled to renounce and abandon the license agreement and should that have been your intention, my Board hereby notify you that they refuse to accept such renunciation and abandonment.

My Board desire to point out that they have in all respects and in all good faith strictly observed the terms and conditions of the agreement, and will continue to do so, and in the same way they expect you to observe the terms and conditions on your part,

I remain, Gentlemen,

Yours faithfully,

(Sgd) A. O. Williams, Sec.

By order of the Board

Filed May 18, 1917.

GEO. W. SPROULE, Clerk.

By H. H. WALKER, Deputy.

Plaintiffs' Exhibit No. 292.

MINERALS SEPARATION
NORTH AMERICAN
CORPORATION
AND

LICENSE

Henry D. Williams,
Attorney and Counselor at Law
61 Broadway,
New York, N. Y.

Plaintiffs' Exhibit No. 292

THIS INDENTURE made the day of 191 BETWEEN MINERALS SEPARATION, NORTH AMERICAN CORPORATION, of 61 Broadway, New York, N. Y., (hereinafter called "the Licensors", which designation shall include its successors and assigns where the context so requires or admits) of the one part and

a corporation organized and existing under the Laws of

and having an office or place for the transaction of business situate at

and whose Mines and Mills are at

(hereafter called "the Licensees") of the other part.

WHEREAS the Licensors are entitled to or otherwise control or are interested in Letters Patent for certain inventions for the concentration and treatment of ores described in the Schedule hereto, and are entitled to grant licenses thereunder.

AND WHEREAS, the Licensors have agreed to grant to the Licensees a license to concentrate and treat all or any ores or any part thereof and or dumps now existing in accordance with all or any of the inventions, processes and apparatus described and claimed in the said Letters Patent and any Letters Patent for the concentration of ores that are or may become the property of the Licensors (all of said Letters Patent being hereinafter called "Letters Patent within this License") at the premises of the Licensees situate in

and known as the

but not elsewhere.

NOW THIS INDENTURE WITNESSETH That in pursuance of the said Agreement and of the matters aforesaid and in consideration of the royalties hereby reserved and of the covenants on the part of the Licensees hereinafter contained the Licensors hereby grant unto the Licensees full license power and authority to make, use and exercise any or all of the inventions described and claimed in the Letters Patent within this license, at the Licensees' mines or mills aforesaid and any extension thereof in

for the purpose of treating all or any of the ores or any part thereof and or dumps now existing, belonging to or controlled by the Licensees won, dug or otherwise produced at the

and to vend the concentrates and other products resulting from the use and exercise of the said inventions during the terms of the Letters Patent within this License or any of them and any ex-

P. 5521, L. 29, after "after" insert "the expiration of each quarter, viz., within thirty (30) days after"

Plaintiffs' Exhibit No. 292

tension thereof subject nevertheless to the following conditions:—

AND IT IS HEREBY AGREED as follows:—

1. THE Licensees shall pay royalties to the Licensors for the use or the right to use processes and appliances embodying any of the inventions described and claimed in the Letters Patent within this license at a rate

2. THE Licensees shall keep at the counting house or office of their said mines proper books of account and shall enter therein full and complete particulars of all the ores and/or dumps treated including assay values thereof and of the concentrates and tailings produced also including assay values thereof. The said books of account shall at all convenient times be open to the inspection of a chartered or incorporated accountant to be appointed by the Licensors. The Licensees shall quarterly deliver to the Licensors an account in writing showing the quantity, assay and other particulars of the ores and/or dumps treated during each quarter and the quantity, assay, values of metal contents and other particulars of the concentrates or products produced or recovered under this license and the assay of the tailings. The Licensees shall if so required by the Licensors verify the said accounts by affidavit. The said quarterly accounts shall be delivered to the Licensors within thirty (30) days after March 31st, June 30th, September 30th

and December 31st, starting with the quarter day immediately following the date of this license. The Licensees shall within ten days thereafter pay to the Licensors free of exchange in New York the full amount thereby shown to be due.

3. THE Licensees shall during the continuance of this License promptly communicate and explain to the Licensors every invention or discovery made or used by them which may be an improvement modification or addition to any of the inventions specified in the Letters Patent within this License or may be useful in carrying out any of the processes thereby protected or any addition thereto or modification thereof whether patentable or not which the said Licensees may use or be or become possessed of. All such inventions and discoveries shall so be available for use by the Licensees as if they were contained in the Letters Patent within this License and subject thereto the Licensors shall be entitled to have the full benefit of and if obtainable to obtain Letters Patent for any such improvements or discoveries communicated to them by the Licensees, which said Letters Patent shall be and become the property of the Licensors, and the Licensees shall render all assistance in their power for that purpose, provided that the Licensors shall bear all the charges and expense of obtaining such Letters Patent for all or any of such parts of the world as they may desire to protect or apply for, and such Letters Patent when obtained shall be and become Letters Patent within this License, and the Licensees shall so far as practicable bind their

employees to assign or transfer to the Licensors any inventions made by such employees during their period of employment by the Licensees. The Licensees shall not without the written consent of the Licensors during the continuance of this License use or employ any improvement modification or addition to any of the inventions specified in the Letters Patent within this License which said improvement modification or addition is not the property of the Licensors.

4. THE Licensors shall whenever required (on the Licensees paying out of pocket expenses) give all assistance, information and advice in their power as to the working of any of the said inventions and shall use their best endeavors to enable the Licensees to use and exercise said inventions to the best advantage, and in like manner the Licensees shall use their utmost endeavors to promote the success of the said inventions and enable them to be used and exercised to the best advantage.

5. THE Licensees shall not directly or indirectly during the continuance of this License nor at any time after the determination thereof dispute or object to the validity of the Letters Patent within this License or the novelty or utility of the inventions specified therein.

6. THE Licensees shall not either directly or indirectly during the continuance of the Letters Patent within this License or any of them use the said inventions or processes or any improvement or modification thereof or addition thereto otherwise than in accord-

ance with these presents, and the Licensees hereby undertake and agree that they, their officers and agents, will not in any way directly or indirectly support or assist third or hostile parties in any litigation either against the Licensors or any Licensees of the Licensors or against Minerals Separation, Limited, of London, England, or its subsidiary or associated companies or successors owning patents in the British Empire or any foreign countries for the inventions protected by the Letters Patent within this license, or its or their Licensees, or by the Licensors or said Minerals Separation, Limited, or said other companies, against others.

7. THE Licensees shall not assign or sublet this License or sell or dispose of any machinery or apparatus the subject matter of any of the said Letters Patent without the written consent of the Licensors such consent not to be withheld in the case of a bona fide sale of the Licensees' undertaking or a substantial part thereof to a responsible person or company who will undertake to enter into a License when called upon so to do by the Licensors in the same terms as near as may be as are herein contained (but subject to the approval of the Licensors) and the Licensors agree to execute if called upon so to do such a License to such bona fide purchaser.

8. THE Licensees shall permit the officers or the duly authorized representatives of the Licensors at all reasonable times during the continuance of this License to enter upon the works and property of the Licensees

Plaintiffs' Exhibit No. 292

and inspect the plant and processes there being used according to the inventions contained in the Letters Patent within this License and to take any samples and to make such assays analyses or tests as may be desirable for the purpose of checking the Licensees' accounts or testing the said plant or processes and will also permit should the Licensors or their agents so desire reasonable access to intending Licensees to see the plant at work.

9. THE Licensees shall at any time if so required supply to the Licensors or their duly authorized representatives full detailed information as to the working of any of the inventions the subject matter of any of the Letters Patent within this License. And the Licensees shall not without the written consent of the Licensors communicate any detail connected with the working of any of the said inventions modifications, additions or improvements to any third party.

10. THE Licensors when required by the Licensees but at the cost of the Licensees shall prepare and supply as soon as may be possible plans and specifications of the plant for the working of the said inventions. The Licensors shall if requested by the Licensees and as soon as may be possible to send to the Licensees' said works an engineer or member of its staff to advise as to the operation of the said inventions. The Licensees shall pay the salary of the said advisor which shall be at the rate of

dollars per month for such period of time as he shall be engaged in such advisory capacity including the time spent in travel to and from the works of the Licensees, such period of time to be mutually agreed upon, and the Licensees shall pay all legitimate expenses traveling and otherwise of said advisor from the time the said advisor shall start for such works until he shall return therefrom.

11. THE Licensors hereby covenant with the Licensees that the Licensees paying the royalties hereby reserved and observing and performing the covenants on their part herein contained shall at all times during the term of years for which the Letters Patent within this License are granted or any extension thereof peaceably and quietly hold, exercise and enjoy the License hereby granted without any interruption or disturbance by the Licensors or any person lawfully claiming by, through or in trust for them.

12. IN the event of any proceedings being taken against the Licensees for the infringement of any patent rights in the use or exercise of any invention for the time being subject to this License the Licensors shall have the right at their own cost to defend any such proceedings in the name of and on behalf of the Licensees and the Licensees hereby agree to render to the Licensors all possible aid (other than monetary) in connection with such proceedings and to notify immediately the Licensors in writing in the event of any such proceedings being instituted. And the Licensors shall pay all costs charges and expenses incurred by reason of any such proceedings so to be defended and

Plaintiffs' Exhibit No. 292

taken over by them (the Licensors) as aforesaid. Provided that if any proceedings are taken against the Licensees by parties against whom the Licensees are precluded by contractural relations from riasing any of the defenses open to them and the Licensors elect to defend such proceedings in the name of the Licensees then the Licensees shall bear and pay all costs and damages in connection therewith.

13. PROVIDED ALWAYS that if any royalties payable hereunder by the Licensees or any part thereof respectively shall remain unpaid for thirty days after the time hereinbefore appointed for payment$ thereof whether demanded or not or if the Licensees shall make default in any other obligation by them herein contained and in case the non-payment of royalties or of any breach capable of being made good shall for the space of thirty days after they shall have been served with a notice in writing by the Licensors to make good such non-payment or breach neglect or omit so to do or if the Licensees should cease for the period of twelve calendar months to use and work the said inventions or should be wound up by reason of inability to meet their liabilities then the Licensors at any time thereafter and notwithstanding any merely implied waiver by them of their rights so to do may by serving the Licensees or their liquidator (if any) with a notice in writing for this purpose forthwith revoke this License without prejudice however to the recovery by the Licensors of any money then already

Plaintiffs' Exhibit No. 292

due or any right of action by or on behalf of them for past breaches accrued hereunder.

14. THIS Contract shall be construed in all respects and take effect as a contract made in the State of New York, and in accordance with the Laws of said State.

15. ANY notice hereunder may be given by either party to the other of them by sending it through the post in a prepaid registered letter addressed to them at the address designated by the other party and last known to the party sending said notice and such notice shall be deemed to have been served in due course of post, and in proving the service thereof it shall be sufficient to show that the letter containing the same was properly addressed and registered.

Signed, sealed and delivered by the parties hereto, in duplicate, the day and year first above written.

....

....

....

Attest:

....

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Attest:

....

Plaintiffs' Exhibit No. 292

STATE OF
County of } ss.:

On the day of in the

year One thousand nine hundred and

before me personally came

to me known, who, being by me duly sworn, did depose and say that he resides in

that he is the of the Minerals Separation North American Corporation, the licensor corporation described in and which executed the above instrument; that he knows the seal of said corporation; that the seal affixed to said instrument is such corporate seal; that it was so affixed by order of the Board of Directors of said corporation, and that he signed his name thereto by like order; and he acknowledged the said instrument to be the free act and deed of the said corporation.

....

....

Plaintiffs' Exhibit No. 292

STATE OF
County of } ss.:

On the day of in the

year One thousand nine hundred and .

before me personally came

to me known, who, being by me duly sworn, did depose and say that he resides in

that he is the of the

the licensee corporation described in and which executed the above instrument; that he knows the seal of said corporation; that the seal affixed to said instrument is such corporate seal; that it was so affixed by order of the Board of Directors of said corporation, and that he signed his name thereto by like order; and he acknowledged the said instrument to be the free act and deed of the said corporation.

....

....

P. 5531, L. 53, erase " Agitating Apparatus " and insert " Apparatus for Ore Concentration."

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Plaintiffs' Exhibit No. 292

THE SCHEDULE ABOVE REFERRED TO UNITED STATES LETTERS PATENT

Nos.	Date	Name	Description
763,259	June 21, 1904	A. E. Cattermole	Classification of the Metallic Constituents of Ores
763,260	June 21, 1904	A. E. Cattermole	Separation of the Metallic Constituents of Ores from Gangue
763,749	June 28, 1904	Goyder & Laughton	Separation of Minerals
776,145	Nov. 29, 1904	C. V. Potter	Process of Separating Metals from Sulphide Ores
777,273	Dec. 13, 1904	A. E. Cattermole	Separation of the Metallic Constituents of Ores from Gangue
777,274	Dec. 13, 1904	Cattermole, Sulman & Picard	Concentration of Minerals from Ores
784,999	Mar. 14, 1905	Goyder & Laughton	Separating and Concentrating Minerals
788,247	Apr. 25. 1905	Cattermole, Sulman & Picard	Ore Concentration
793,808	July 4, 1905	Sulman & Picard	Ore Concentration
809,959	Jan. 16, 1906	E. B. Kirby	Process of separating minerals
835,120	Nov. 6, 1906	Sulman, Picard & Ballot	Ore Concentration
835,143	Nov. 6, 1906	H. L. Sulman	Ore Concentration
835,179 4	Nov. 6, 1906	Sulman, Picard & Ballot	Ore Concentration
838,626	Dec. 18, 1906	E. B. Kirby	Separating Tank
864,597	Aug. 27, 1907	A. J. F. DeBavay	Separating Zinc Blende by Flotation
879,985	Feb. 25, 1908	H. L. Sulman	Separation of Metalliferous Minerals from Gangue
902,018	Oct. 27, 1908	H. L. & E. S. Sulman	Ore Concentration
912,783	Feb. 16, 1909	A. J. F. DeBavay	Apparatus for Separating Ores
953,746	Apr. 5, 1910	T. J. Hoover	Apparatus for Ore Concentration
955,012	Apr. 12, 1910	H. L. Sulman	Ore Concentration
962,678	June 26, 1910	Sulman, Greenway & Higgins	Ore Concentration
979,857	Dec. 13, 1910	T. J. Hoover	Apparatus for ore concentration
,045,970	Dec. 3, 1912	T. J. Greenway	Separation of Metallic Sulphides from Sulphide ores
,064,209	June 10, 1913	James Hebbard	Apparatus for Ore Concentration
,064,723	June 17, 1913	Greenway & Layers	Ore Concentration
,067,485	July 15, 1913	Nutter & Lavers	Ore Concentration
,071,784	Sept. 3, 1913	E. H. Nutter	Valve for Thick Pulp
,079,107	Nov. 18, 1913	Chapman & Tucker	Ore Concentration
,084,196	Jan. 13, 1914	Broadbridge & Howard	~~Agitating Apparatus~~
,084,210	Jan. 13, 1914	A. C. Howard	Agitating Apparatus
,093,463	Apr. 14, 1914	Nutter & Hoover	Method and Apparatus for ore concentration

Plaintiffs' Exhibit No. 292

Nos.	Date	Name	Description
1,099,699	June 9, 1914	H. H. Greenway	Ore concentration
1,101,506	June 23, 1914	Leslie Bradford	Process and apparatus for separation of metallic sulphide from gangue
1,102,738	July 7, 1914	Greenway & Lowry	Ore concentration
1,102,873	July 7, 1914	Chapman & Tucker	Ore concentration
1,102,874	July 7, 1914	G. A. Chapman	Ore concentration
1,142,821	June 15, 1915	Henry Lavers	Separation of mixed sulphide ores
1,142,822	June 15, 1915	J. W. Littleford	Ore concentration
1,155,815	Oct. 5, 1915	Higgins & Stenning	Apparatus for ore concentration
1,155,816	Oct. 5, 1915	A. H. Higgins	Apparatus for ore concentration
1,155,836	Oct. 5, 1915	T. M. Owen	Apparatus for ~~ore~~ the concentration of ores
1,155,861	Oct. 5, 1915	L. A. Wood	Ore concentration
1,170,637	Feb. 8, 1916	A. H. Higgins	Ore concentration
1,170,665	Feb. 8, 1916	E. H. Nutter	Ore concentration
1,178,191	Apr. 4, 1916	Sulman & Picard	Copper Precipitant
1,187,772	June 20, 1916	G. E. Ohrn	Ore concentration
1,203,341	Oct. 31, 1916	A. C. Howard	Ore concentration
1,203,372	Oct. 31, 1916	F. J. Lyster	Separation of metallic sulphide ores
1,203,373	Oct. 31, 1916	F. J. Lyster	Ore concentration
1,203,374	Oct. 31, 1916	F. J. Lyster F. J. Lyster	Ore concentration
1,203,375	Oct. 31, 1916	~~Lavers, Lowry & Greenway~~	Ore concentration
1,208,171	Dec. 12, 1916	Lavers, Lowry & Greenway	Concentration of sulphide ores
1,208,334	Dec. 12, 1916	Lavers, Greenway & Lowry	Ore concentration

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Plaintiffs' Exhibit No. 293.

MODEL—KIRBY MIXING TANK "A."

(Physical Exhibit.)

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Plaintiffs' Exhibit No. 294.

MODEL—SEPARATING TANK "B."

(Physical Exhibit.)

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Plaintiffs' Exhibit No. 295.

MODEL—GABBETT MACHINE.

(Physical Exhibit.)

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Plaintiffs' Exhibit No. 296.

MODEL—CATTERMOLE UPCASTING MACHINE.

(Physical Exhibit.)

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Plaintiffs' Exhibit No. 297.

MODEL—SLIDE GABBETT MACHINE.

(Physical Exhibit.)

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Plaintiffs' Exhibit No. 298.

BAR MIXER.

(Physical Exhibit.)

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Plaintiffs' Exhibit No. 299.

BATEA.

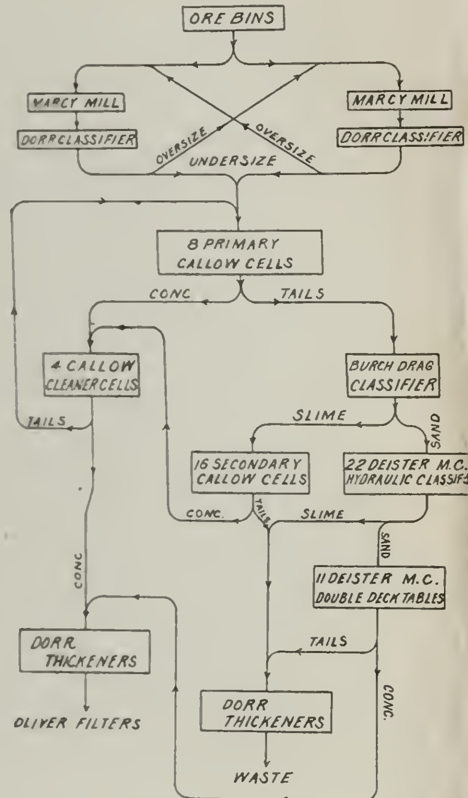
(Physical Exhibit.)

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

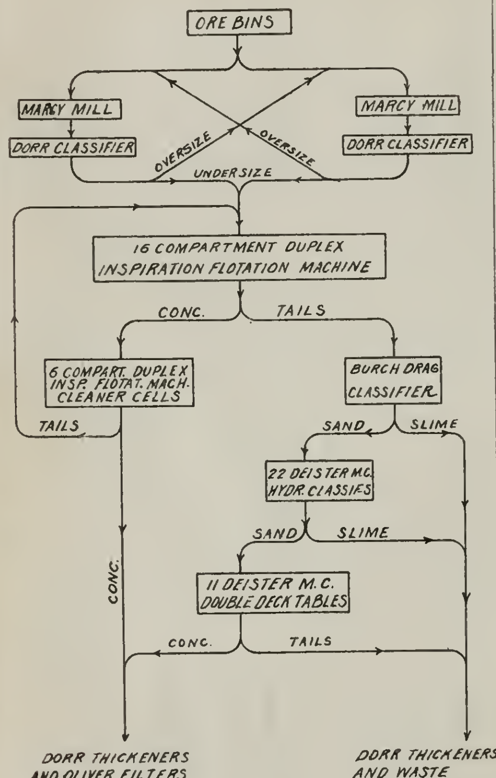
PLAINTIFF'S EXHIBIT No. 300

FLOW SHEET OF INSPIRATION MILL

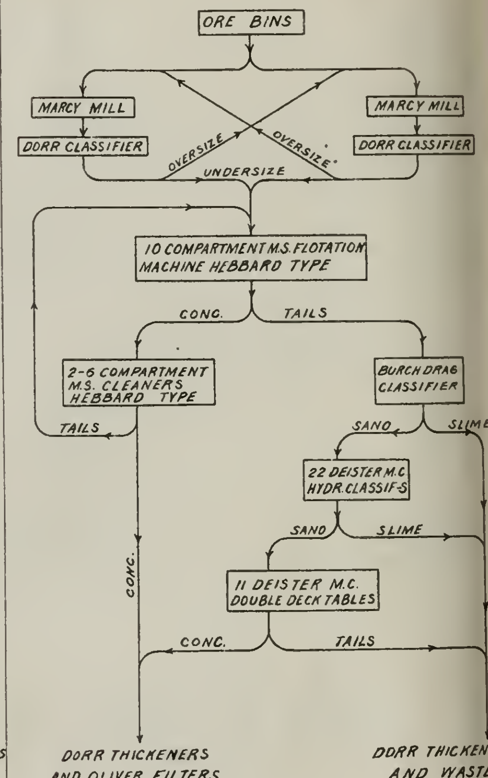
SECTIONS EQUIPPED WITH CALLOW FLOTATION MACHINES



SECTIONS EQUIPPED WITH INSPIRATION FLOTATION MACHINES



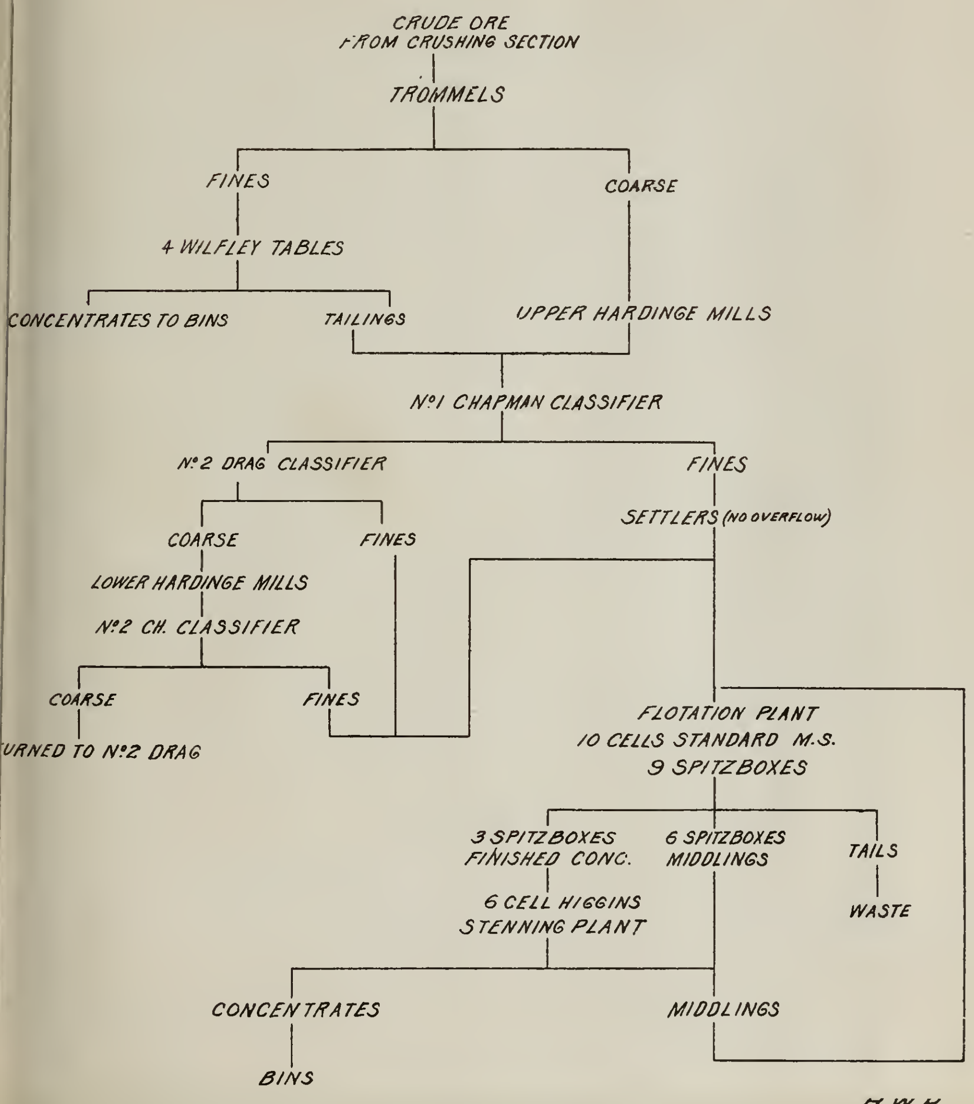
SECTIONS EQUIPPED WITH MINERALS SEPARATION FLOTATION MACHINES



Filed May 18, 1917. GEO. W. SPROULE, Cl[...]
By H. H. WALKER, De[...]

PLAINTIFF'S EXHIBIT No. 301.

FLOW SHEET
BRADEN COPPER CO.
OLD MILL, MOLINO, CHILE.



Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Defendant's Exhibit No. 302.

Results of an Experiment Performed in Court and Testified to by
B. H. DOSENBACH

MINIATURE FLOTATION PLANT

Test No. 39.

Operation of Miniature Flotation Plant (Def. Exhibit No. 226) in court by B. H. Dosenbach.

Page 1863 (Description)

Ore used ....60 Pounds

Butte & Superior ore containing 14.65% zinc.

Water used ....146 Pounds

Ordinary tap water at temperature of 16° Centigrade.

Oil used ....1.266 Pounds

Butte & Superior Oil Mixture consisting of 70% fuel oil, 18% pine oil and 12% kerosene.

AMOUNT OF OIL RELATIVE TO ORE—2.11%

Acid used ....65 c.c.

Commercial sulphuric acid having a specific gravity of 59 degrees Be. This amount used as equivalent to 8 pounds per ton of ore.

Copper Sulphate Solution used..78 c.c.

Anaconda Copper Mining Company's sulphate solution equivalent to approximately 0.10 pounds metallic copper per ton of ore.

Entire Heading % Zinc	Entire Tailing % Zinc	Entire Concentrate % Zn	% Ins	% Oil	Apparent Recovery % Zinc
14.65	3.27	48.9	11.6	5.09	83.24

SPECIAL SAMPLES

(Cuts made during normal operations)

Concentrate froth:—

	% Zinc	% Insol	% Oil
1st, 2nd and 3rd cuts from recleaner	56.2%	4.0%	5.59%
3rd and 4th cuts from recleaner	55.6%	4.8%	3.98%

Tailing sample:—
Sample cut for court inspection................ 1.15%

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Defendant's Exhibit No. 303.

BUTTE & SUPERIOR MINING COMPANY

May 5, 1917.

Mr. J. T. Shimmin,
Mill Superintendent,
Plant.

Dear Sir:—

The enclosed data shows the weights and assays of screen analyses run on samples taken in the plant on April 29th, 1917, of which description was reported to you on May 1st.

The screens reported here are as follows:—

A composite of flotation feed samples, general mill tailings, also a composite, primary tailings, primary middlings, cleaner flotation concentrates, slime feed to the sludge tank, and tube mill discharge. Concentrates from the first, second and third spitz and the first, second and third cleaner tailings were not screened as the rejects were too small to permit.

Yours truly,

(Signed) T. R. FEARLERLY,
Head Sampler.

TRF:JDS

Defendant's Exhibit No. 303

BUTTE & SUPERIOR MINING COMPANY

SCREENING ANALYSES—1:00 to 5:00 P. M.—APRIL 29th, 1917.

Mesh	Weight	% Weight	Accumulative Per cent Weight	Weight Zinc	% Zn.	% Weight Zinc	Accumulative % Weight Zinc
Primary Middling—One Bucket 4th, 5th, 6th & 7th Spitz							
Original	400				10.8		
Plus 48	00.00	00.00					
65	15.00	3.79	3.79	2.69	17.9	6.17	6.17
80	18.00	4.55	8.34	3.20	17.8	7.34	13.51
100	13.00	3.28	11.62	2.21	17.0	5.07	18.58
150	60.00	15.15	26.77	6.60	11.0	15.14	33.72
200	36.00	9.09	35.86	3.24	9.0	7.43	51.15
280	35.00	8.84	44.70	4.41	12.6	10.12	51.27
Minus 280	219.00	55.30	100.00	21.24	9.7	48.73	100.00
Total	396.00	100.00		43.59		100.00	
Cleaner Flotation Concentrates—Finished Product to Thickener Tanks One Bucket							
Original	400				45.2		
Plus 48							
65	13.0	3.28	3.28	5.04	38.8	2.88	2.88
80	8.0	2.02	5.30	3.26	40.7	1.87	4.75
100	22.0	5.56	10.86	9.26	42.1	5.30	10.05
150	50.0	12.63	23.49	22.60	45.2	12.93	22.98
200	29.0	7.32	30.81	13.51	46.6	7.73	30.71
-200	274.0	69.19	100.00	121.10	44.2	69.29	100.00
Total	396.0	100.00		174.77		100.00	

NOTE:—Impossible to put through 280 mesh on account of material being too oily.

Slime Feed to Sludge Tank

Original	400.00				13.6		
Plus 80	10.0	2.51	2.51	1.41	14.1	2.90	2.90
100	15.0	3.77	6.28	1.58	10.5	3.25	6.15
150	65.0	16.33	22.61	6.11	9.4	12.60	18.75
200	40.0	10.05	32.66	4.60	11.5	9.47	28.22
- 200	268.0	67.34	100.00	34.84	13.0	71.78	100.00
Total	398.0	100.0		48.54		100.0	

TUBE MILL DISCHARGE

No. 4 Section 1 and No. 1 Section 2

Original	400.00				8.9		
Plus 48	37.0	9.30	9.30	1.67	4.5	4.45	4.45
65	75.0	18.84	28.14	4.13	5.5	11.00	15.45
80	49.0	12.31	40.45	3.38	6.9	9.01	24.46
100	62.0	15.58	56.03	5.08	8.2	13.54	38.00
150	78.0	19.60	75.63	9.13	11.7	24.33	62.33
200	23.0	5.78	81.41	3.11	13.5	8.28	70.61
- 200	74.0	18.59	100.00	11.03	14.9	29.39	100.00
Total	398.0	100.00		37.53		100.00	

Defendant's Exhibit No. 303

BUTTE & SUPERIOR MINING COMPANY

SCREENING ANALYSES—1:00 to 5:00 P. M.—APRIL 29th, 1917.

Mesh		Weight	% Weight	Accumulative Per cent Weight	Weigth Zinc	% Zn.	% Weight Zinc	Accumulative % Weight Zinc
General Mill Tailings Composite—Three Buckets								
Original		400.00				1.57		
Plus	48	10.00	2.53	2.53	.40	3.95	5.71	5.71
	65	40.00	10.10	12.63	1.30	3.25	18.57	24.28
	80	32.00	8.08	20.71	.69	2.15	9.86	34.14
	100	35.00	8.84	29.55	.49	1.40	7.00	41.14
	150	58.00	14.65	44.20	.65	1.12	9.29	50.43
	200	60.00	15.15	59.35	.64	1.07	9.14	59.57
	280	20.00	5.05	64.40	.15	.77	2.14	61.71
	- 280	141.00	35.60	100.00	2.68	1.90	38.29	100.00
Total		396.00	100.00		7.00		100.00	
Primary Tailings—One Bucket								
Original		400.00				1.16		
Plus	48	15.00	3.77	3.77	.56	3.70	10.31	10.31
	65	58.00	14.61	18.38	1.74	3.00	32.04	42.35
	80	19.00	4.79	23.17	.33	1.75	6.08	48.43
	100	40.00	10.07	33.24	.50	1.25	9.21	57.64
	150	78.00	19.65	52.89	.68	.87	12.52	70.16
	200	42.00	10.58	63.47	.26	.62	4.70	74.95
	280	35.00	8.82	72.29	.20	.57	3.69	78.64
	- 280	110.00	27.71	100.00	1.16	1.04	21.36	100.00
Total		397.00	100.00		5.43		100.00	
Flotation Feed Composite—Six Buckets								
Original		400.00				12.6		
Plus	48	5.00	1.27	1.27	.43	8.5	.85	.85
	65	37.00	9.37	10.64	4.74	12.8	9.36	10.21
	80	25.00	6.33	16.97	3.30	13.2	6.51	16.72
	100	30.00	7.59	24.56	4.32	14.4	8.53	25.25
	150	58.00	14.68	39.24	7.42	12.8	14.65	39.90
	200	32.00	8.10	47.34	3.84	12.0	7.58	47.48
	280	39.00	9.87	57.21	4.80	12.3	9.48	56.96
	- 280	169.00	42.79	100.00	21.80	12.9	43.04	100.00
Total		395.00	100.00		50.65		100.00	

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Defendant

RESULTS OF EXPERIMENTS PERF
B. H.

eration	Refer. Record Page No.	Apparatus	ORE USED Kind	Amt. Grams	% Zn.	% Cu.	% Fe.	% Insol.	Kind
erson st No. 30	Page 1211 " 1212	After Description in Fryer Hill Publication	Cu.	300		8.14	4.90	78.0	Petroleu Distillate
erson st No, 31	" 1223	Cattarract	Cu.	200		6.14	6.65	74.5	Texas Distillate
by st No. 32	" 1224 " 1228	Sq. Glass agitator	Cu.	300		5.87	6.76	75.4	Petroleur Distillate
te & perior	" 1281	Sq. Glass agitator	Zn.	300	17.4			64.0	Oil Mixt
ernate termole & in suit st No. 33	" 1262 " 1263	Cone Gabbett Mach.	Zn.	300	14.7	0.16	1.94	67.0	Oleic A
te & Super- Test No. 36	1283	"	Zn.	300	14.7			67.0	Pine Ta

304.

URT AND TESTIFIED TO BY

Oil re	ACID Kind	ACID Amount c.c.	ACID Amount Grams	WATER Amt. c.c.	WATER Temp. Deg. C.		ASSAYS % Zinc	ASSAYS % Cu.	ASSAYS % Ins.	ASSAYS % Fe.	ASSAYS % Oil
1%	Sulphuric	2.4	4.41	1250	42°	Mineral Froth		226.60	12.0	25.92	4.85
%	"	1.6	2.94	1250	30°	Mineral Froth		23.67	20.8	22.5	6.65
%	"	2.0	3.68	1500	25°	Mineral Froth		23.94	21.0	23.5	9.62
5	Copper Sul. Sulphuric	.51 .67	1.102 1.23	1500	30°	Mineral Froth	47.10		16.0		0.64
5	Sulphuric	1.0	1.84	1500	35°	Mineral Froth					
						1st	42.60		15.40		
						2nd	40.70		16.00		
			Cattermole Granules				32.70		35.60		2.03
			Upcast Overflow				3.90		87.80		1.12
62%	Sulphuric	.05	.92	1250	35°	Mineral Froth	33.90		31.20		3.39

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Defendant's Exhibit No. 305.

RESULTS OF AN EXPERIMENT PERFORMED IN COURT AND TESTIFIED TO BY B. H. DOSENBACH

Test No. 34.

Operation performed in Janney Flotation Machine (Def. Exhibit No.) Page 1273.

Ore used 400 Grams
Butte & Superior ore containing 15.3% zinc.

Water used 1900 c.c.
Ordinary tap water at a temperature of 30° Centigrade

Oil used 1½% relative to ore
Butte & Superior oil mixture, consisting of 70% fuel oil, 18% pine oil and 12% kerosene.
6 grams.

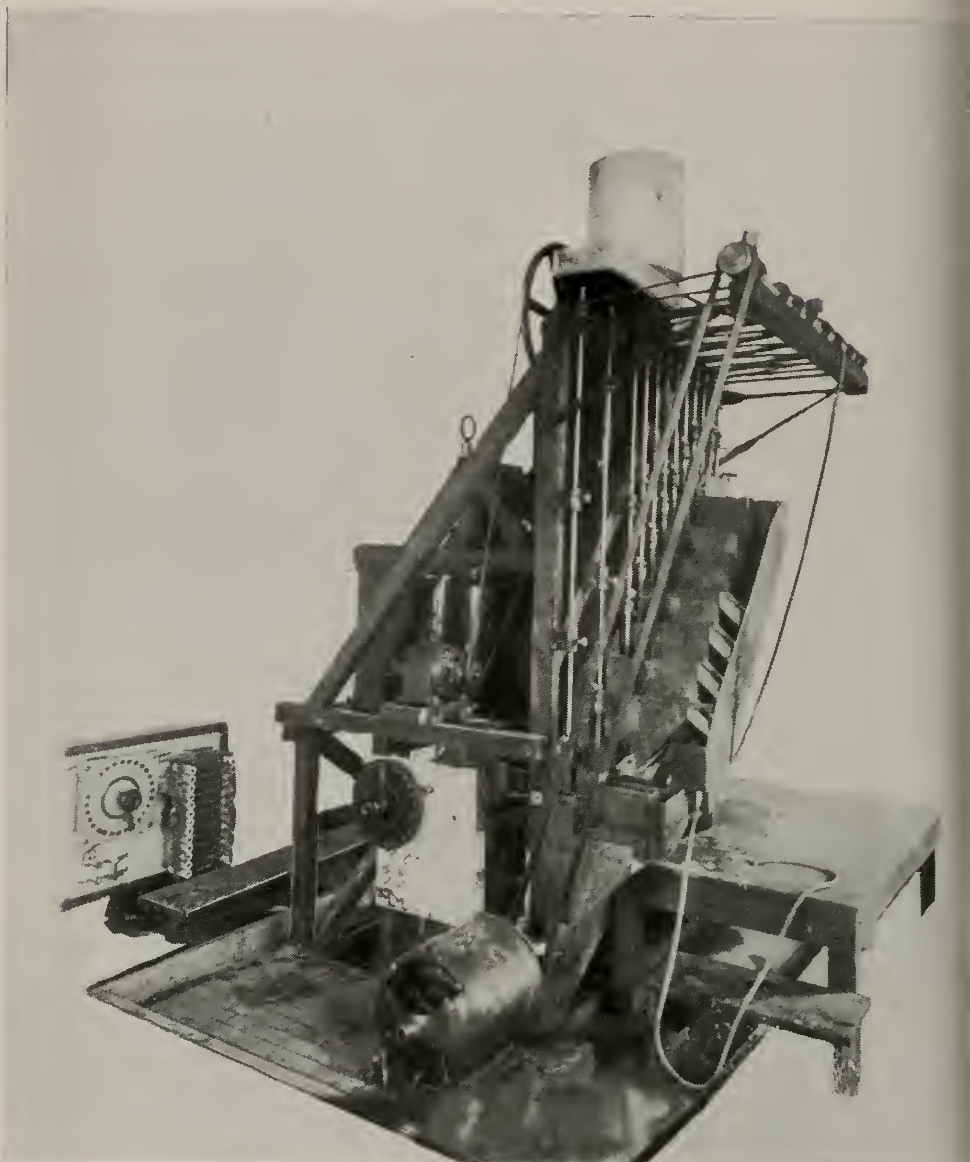
Acid used 0.9 c.c.
Concentrated sulphuric acid (Specific Gravity 1.84)

Copper Sulphate Solution 1.0 c.c.
Anaconda Copper Mining Company's copper sulphate solution; equivalent to 0.10 pounds per ton of ore.

Heading	Tailing	Concentrate		Middling	Apparent Recovery
% Zinc	% Zinc	% Zn.	% Oil	% Zinc	% Zinc
15.3	0.44	44.3	2.12	32.5	98.09

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Defendant's Exhibit No. 306.

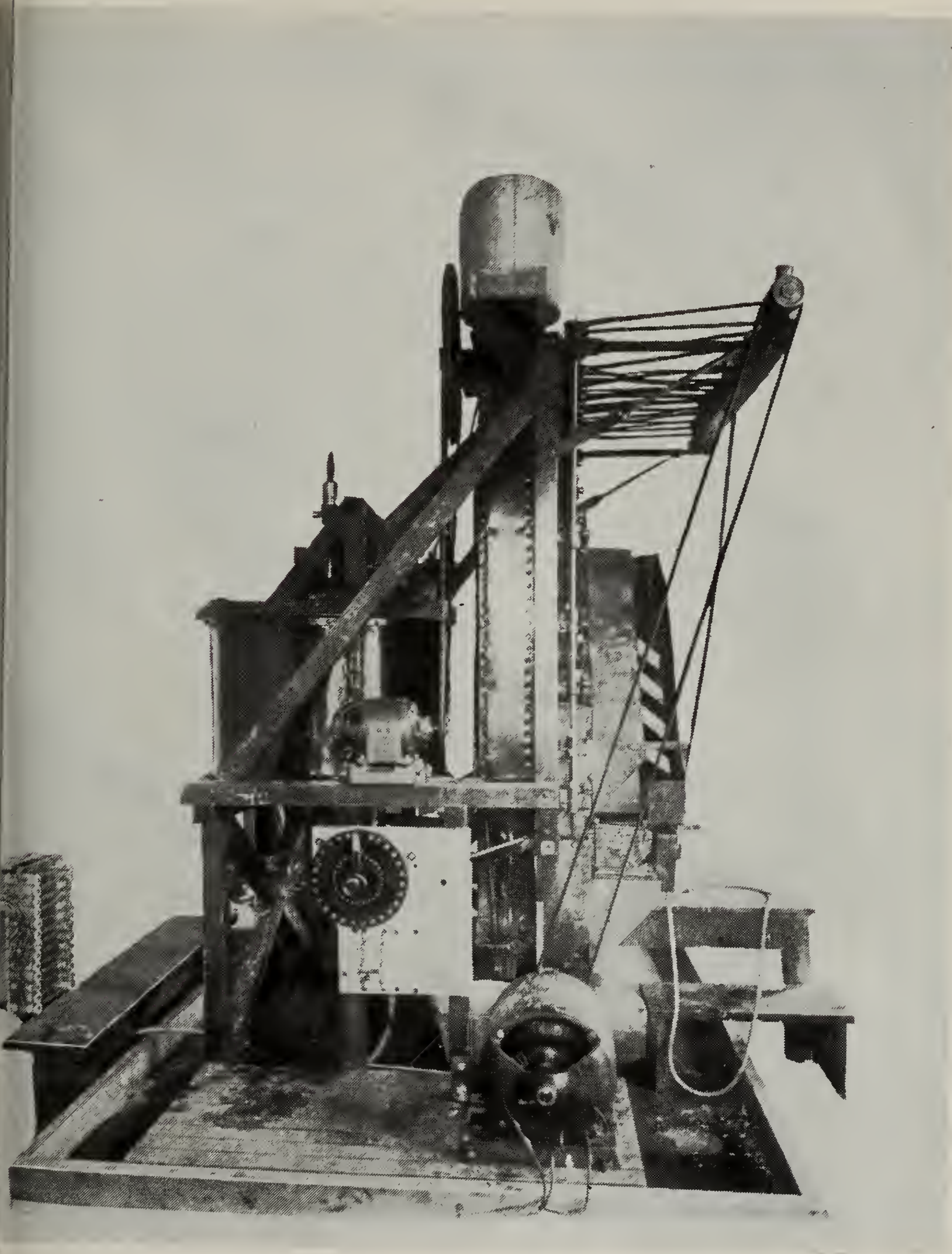


Filed May 18, 1917. GEO. W. SPROULE,
By H. H. WALKER,

Defendant's Exhibit No. 307.

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Defendant's Exhibit No. 308.



Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Plaintiffs' Exhibit No. 309.

ANACONDA COPPER MINING COMPANY

DEPARTMENT OF CONCENTRATION

Reagent Consumption—lbs. per Ton of Flotation Feed
March, 1917

	COPPER SAND			COPPER SLIME			ZINC ORE		
Mar.	Sludge	Creosote	H2SO4	Sludge	Creosote	H2SO4	Sludge	Creosote	H2SO4
1	3.5	.34	8.0	4.3	2.90	19.5	1.0	1.7	29.6
2	3.5	.36	7.7	3.9	2.14	14.1	1.0	1.9	27.6
3	3.6	.36	7.7	3.4	2.51	14.3	1.1	1.8	29.0
4	3.7	.34	7.7	4.2	2.85	19.2	1.1	2.3	28.6
5	3.7	.38	7.9	3.6	2.59	16.2	0.9	1.8	26.5
6	3.7	.34	7.6	4.0	2.71	18.1	0.9	1.7	19.0
7	3.7	.32	7.8	4.0	2.72	17.2	0.8	1.9	26.7
8	3.6	.33	7.9	3.5	2.34	15.0	0.8	1.6	20.7
9	3.7	.31	7.7	3.5	2.38	15.1	0.9	1.6	21.1
10	3.7	.38	7.8	3.4	2.33	15.0	1.5	2.0	25.0
11	3.7	.27	7.9	3.7	2.45	17.3	1.2	1.4	21.4
12	3.7	.32	7.9	3.4	2.20	13.6	0.9	1.4	24.6
13	3.6	.34	7.9	3.6	2.48	15.6	1.0	1.6	33.6
14	3.4	.18	7.9	3.8	2.66	16.8	0.8	1.1	19.0
15	3.5	.22	8.1	4.4	2.69	18.6	0.9	1.6	22.0
16	3.5	None	8.0	3.4	1.92	15.6	0.8	1.4	25.2
17	3.4	.17	8.1	3.9	2.22	16.4	0.8	1.4	23.8
18	3.5	.15	8.1	3.7	2.25	16.4	0.9	1.8	21.3
19	3.4	None	7.9	3.6	2.18	16.2	0.8	1.3	24.2
20	3.4	.41	7.8	3.8	2.32	16.4	1.6	1.5	24.6
21	3.3	None	7.8	3.4	2.16	14.9	1.0	1.9	21.9
22	3.2	.18	8.0	3.3	1.99	14.3	1.0	1.8	29.9
23	3.2	.24	8.1	3.8	2.26	16.8	0.8	1.6	28.4
24	3.3	.20	8.6	3.9	2.25	17.4	0.8	2.0	24.0
25	3.2	.50	8.0	3.6	2.01	14.7	Plant Down		
26	3.1	.30	8.0	3.9	2.31	16.9	1.0	2.4	27.4
27	3.2	.50	8.5	3.7	2.37	17.2	0.9	1.9	33.4
28	3.1	.45	8.2	3.2	1.78	14.1	0.8	1.6	30.3
29	3.1	.40	8.1	3.7	2.34	17.5	1.0	1.5	29.6
30	3.1	.48	8.1	2.9	1.68	13.6	1.2	1.8	29.0
31	3.1	.24	8.2	3.3	1.88	15.1	1.7	1.5	33.8

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Plaintiffs' Exhibit No. 310.

ANACONDA COPPER MINING COMPANY

DEPARTMENT OF CONCENTRATION

Reagent Consumption—lbs. per Ton of Flotation Feed

February, 1917

	COPPER SAND			COPPER SLIME			ZINC ORE		
Feb.	Sludge	Creosote	H_2SO_4	Sludge	Creosote	H_2SO_4	Sludge	Creosote	H_2SO
1	3.5	.57	7.1	3.0	1.94	12.8	1.4	2.5	31.9
2	3.5	.41	7.0	3.0	1.85	12.0	1.0	2.0	19.3
3	3.6	.38	7.1	2.9	1.70	12.0	0.8	1.5	24.6
4	3.3	.32	7.0	3.2	2.19	11.3	1.1	1.5	28.0
5	3.3	.38	7.0	2.8	1.59	11.8	1.2	1.8	23.9
6	3.1	.41	7.2	3.6	2.06	13.5		Missing	
7	2.8	.39	7.3	4.9	2.10	14.8	0.9	1.6	31.9
8	3.3	.38	7.6	4.1	2.00	16.4	0.8	1.5	30.8
9	3.4	.35	7.4	5.3	2.50	21.7	1.0	1.9	30.5
10	3.3	.29	7.3	5.0	2.20	18.9	0.6	1.5	17.5
11	3.4	.24	7.4	3.9	1.65	14.7	0.8	1.6	20.7
12	3.4	.36	7.6	5.4	2.08	18.1	1.0	2.0	27.4
13	3.4	.34	7.6	5.4	1.80	18.7	0.9	1.8	24.0
14	3.4	.33	7.6	5.7	2.09	21.7	0.9	1.8	19.7
15	3.4	.26	7.5	5.8	1.85	21.4	0.8	1.9	17.0
16	3.6	.32	7.7	4.6	2.12	19.9	0.8	1.8	23.1
17	3.5	.31	7.8	5.7	3.10	24.4	1.1	2.2	26.0
18	3.6	.36	8.1	4.1	2.43	18.9	1.2	1.9	26.6
19	3.6	.32	7.8	3.9	2.54	19.2	0.8	2.0	24.7
20	3.8	.39	7.6	3.8	2.23	16.1	0.9	1.9	24.0
21	3.7	.37	7.9	3.8	2.20	17.2	1.0	1.9	18.5
22	3.7	.39	7.9	4.1	2.53	18.9	0.8	1.5	21.5
23	3.7	.24	7.7	3.9	2.41	17.4	0.8	1.8	26.3
24	3.6	.31	7.8	3.8	2.35	17.0	1.3	2.4	37.4
25	3.6	.45	7.8	3.9	2.42	17.6	1.5	2.0	34.6
26	3.6	.39	7.7	4.4	2.44	17.7	2.0	3.6	50.4
27	3.6	.28	7.8	4.1	2.28	21.1	1.0	2.2	30.6
28	3.6	.25	7.7	3.9	2.38	16.1	0.9	2.1	25.0

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Plaintiffs' Exhibit No. 311.

ANACONDA COPPER MINING COMPANY

DEPARTMENT OF CONCENTRATION

Reagent Consumption—lbs. per Ton of Flotation Feed

January, 1917

	COPPER SAND			COPPER SLIME			ZINC ORE		
n.	Sludge	Creosote	H_2SO_4	Sludge	Creosote	H_2SO_4	Sludge	Creosote	H_2SO_4
1	2.6	.22	6.8	2.9	1.75	13.2	0.5	2.6	20.7
2	3.3	.20	6.9	2.9	1.70	13.7	1.1	3.0	22.2
3	3.1	.22	6.8	3.1	1.90	14.3	0.7	2.3	19.0
4	3.1	.24	6.9	3.7	2.20	15.3	0.8	2.6	19.0
5	3.2	.26	7.2	3.2	1.90	13.7	0.8	2.7	20.0
6	3.2	.24	7.4	3.6	2.10	15.6	0.9	2.8	19.9
7	3.1	.27	7.2	3.5	2.20	15.7	0.9	2.5	19.1
8	3.1	.25	7.1	3.3	1.95	14.3	0.8	2.5	20.4
9	3.1	.23	7.1	3.4	1.85	14.6	0.8	3.1	24.0
0	3.3	.32	7.3	3.2	1.90	13.2	0.9	2.5	23.0
1	3.2	.26	7.0	3.5	2.10	14.7	0.8	3.1	27.8
2	3.2	.27	7.0	3.5	2.15	15.4	0.8	3.0	30.8
3	3.2	.33	6.9	3.7	2.30	16.0	0.9	2.5	19.4
4	3.4	.24	7.3	3.6	2.35	15.8	0.9	2.9	32.4
5	3.4	.31	7.2	3.8	2.35	15.0	0.9	3.1	25.5
6	3.2	.17	7.0	3.5	2.10	14.9	0.8	2.7	17.7
7	3.1	.23	7.0	3.4	2.15	15.0	0.8	2.9	21.5
8	3.4	.32	7.1	3.7	2.25	14.7	0.4	2.2	22.1
9	3.3	.27	7.1	3.7	2.30	14.9	0.6	2.3	23.9
0	3.4	.26	7.3	3.7	2.25	15.1	0.3	2.5	19.8
1	3.4	.30	7.5	3.6	2.20	14.8	0.9	3.0	28.4
2	3.4	.30	7.2	3.5	2.50	14.2	0.9	2.5	25.5
3	3.4	.41	7.1	3.4	2.20	13.6	0.7	2.6	22.7
4	3.3	.43	7.1	3.4	1.90	13.0	0.8	1.9	19.1
5	3.4	.36	7.1	3.3	2.05	12.9	0.7	2.1	26.4
6	3.4	.37	7.4	3.4	2.15	13.2	0.9	2.8	29.5
7	3.0	.38	7.3	3.8	2.25	14.2	0.8	2.4	28.9
8	3.4	.39	7.2	3.5	2.40	13.5	0.7	2.3	28.1
9	3.4	.50	7.3	3.8	2.05	13.0	1.0	2.2	32.0
0	3.0	.32	7.6	4.0	2.20	14.8	1.2	2.4	26.9
1	3.4	.49	7.4	3.3	1.90	13.0	1.1	2.1	25.0

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy

Plaintiffs' Exhibit No. 312.

ANACONDA COPPER MINING COMPANY

DEPARTMENT OF CONCENTRATION

Current Mill Slime—Per Cent Cu.

	JANUARY	FEBRUARY	MARCH
1	2.63	2.44	2.51
2	2.63	2.71	2.80
3	2.47	2.78	2.57
4	2.75	2.65	2.66
5	2.67	2.60	2.39
6	3.06	2.81	2.60
7	2.31	2.61	2.30
8	2.67	2.40	2.47
9	2.69	2.77	2.46
10	2.50	2.83	2.73
11	2.60	2.65	2.81
12	2.81	2.68	2.45
13	2.47	2.65	2.93
14	2.65	2.72	2.81
15	2.54	2.61	2.41
16	2.82	2.96	2.33
17	2.66	2.40	2.64
18	2.73	2.44	2.51
19	2.53	2.42	3.07
20	2.66	2.77	2.76
21	2.82	2.25	2.72
22	2.73	2.70	2.84
23	2.57	2.52	2.54
24	2.76	2.71	2.38
25	2.60	2.63	3.15
26	2.82	2.77	2.62
27	3.10	2.37	2.49
28	2.54	2.85	2.74
29	2.70		2.69
30	2.84		2.83
31	2.67		2.83

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Plaintiffs' Exhibit No. 313.

ANACONDA COPPER MINING COMPANY
DEPARTMENT OF CONCENTRATION

Reagent Consumption and Sulphide Content of Ore—Jan., 1917

							REAGENTS USED LBS. PER TON			
T—	% Cu.	% Pb.	% Zn.	% Fe.	% S	% Sulphide	Sludge	Creosote	Total Oil	H2SO4
and	1.0			4.0	5.0	10.3†	3.4	0.1	3.5	6.8
lime	2.6			4.2	6.0	12.8	3.6	1.9	5.5	13.8
	0.7	3.0	13.2	7.0	14.7	38.6	0.7	2.7‡	3.4	22.7

of 60% Creosote from Cleveland Cliffs Iron Co., Marquette, Mich., and 40% ar special from Georgia Pine Turpentine Co.

mill operations we treat 0.578x2000=1156 tons of Sand and approximately 120 lime in each section. Therefore, the true total sulphide figure for the "sand" feed in the mill should be $\frac{1156X10+120X13.4}{1276}$=10.3. This accounts for dis- between figure shown and addition which would be 10.0%. The total sulphide ime returned to the mill for treatment is 13.4%.

Filed May 18, 1917. By H. H. WALKER, Deputy.
GEO. W. SPROULE, Clerk.

Plaintiffs' Exhibit No. 314.

ANACONDA COPPER MINING COMPANY
DEPARTMENT OF CONCENTRATION

Reagents Consumption and Sulphide Content of Ore—Feb. 1917

							REAGENTS US[illegible] LBS. PER TO[illegible]		
PRODUCT—	% Cu.	% Pb.	% Zn.	% Fe.	% S	% Sulphide	Sludge	Creosote	Total Oil
(Mixed) Copper Sand	1.15			5.2	4.8	11.15	4.01	.13	4.14
Copper Slime	2.50			4.1	5.4	12.00	4.85	2.12	6.97
Zinc Ore	.69	2.8	12.35	7.5	12.6	35.94	1.00	2.40	3.40

Filed May 18, 1917. GEO. W. SPROULE, Cle
By H. H. WALKER, Dep

Plaintiffs' Exhibit No. 315.

ANACONDA COPPER MINING COMPANY
DEPARTMENT OF CONCENTRATION

Reagent Consumption and Sulphide Content of Ore—Mar. 1917

							REAGENTS USE LBS. PER TON		
PRODUCT—	% Cu.	% Pb.	% Zn.	% Fe	% S	% Sulphide	Sludge	Creosote	Total Oil
(Mixed) Copper Sand	1.24			5.5	4.9	11.64	2.94	.05	2.99
Copper Slime	2.40			4.3	5.5	12.20	3.15	2.11	5.26
Zinc Ore	.54	3.0	13.48	6.45	13.6	37.07	.80	1.44	2.24

Filed May 18, 1917. GEO. W. SPROULE, C
By H. H. WALKER, D

Defen

MINERALS SEPARATION COMPANY, LIMI

Referring to Defendant's Exhibit No. 29 Chino Copper Comp

PERIOD	HEADING TO FLOTATION				FLOTATION CONCENTRATES			RECOVERY % CU.		
	Tons	Assay % Cu.	Contents Lbs. of Cu.	Ratio of Concentration	Tons	Assay % Cu.	Contents Lbs. of Cu.	Calculated by Contents	Given in Exh. 29	Tons by
1916 3rd Quarter	26804	7.01	3757921	3.94	6804	27.10	3687768	98.13	96.717	200
1916 October	9794	7.77	1521988	3.40	2884	26.03	1501410	98.65	98.17	69
1916 Nov. 18, 19, 20	561	10.24	114893	2.95	190	29.78	113164	98.49	98.423	3

Recompiled May 13th, 1917, by F. R. Wicks t N. 316.

VS. UTTE & SUPERIOR MINING COMPANY

t of Vanner Concentrates. Mr. Wick's Evidence Q 25 and Q 26.

ay (	Cu.	LOSS OF CU. IN TAILINGS PER LB. CU. IN HEADINGS		COST OF SMELTING CONCTS.			COST OF CONCENTRATION			OIL	OTHER REAGENTS
ontents	Given in Exh. 29	Lbs. in Tailings per lbs. in Heads	Val. if One lb. Cu. in Conc. be Worth 20c Net to the Mill.	Smelting Chg. & Frt. per Ton of Conc.	Total	Per Lb. Cu. in Heading	Cost of Oil per Lb. Cu. in Heading	Cost of Reagents per Lb. Cu. in Heading	Total Oil, Reagents & Loss in Tails (per Lb. Cu. in Heads)	Lbs. per Ton of Heading	Lbs. per Ton of Heading
'5	.306	0.0186	$0.00372	$6.00	$40824	$0.01086	$0.0153	$0.00137	0.01595	8.76	4.57
9	.200	0.0135	0.00270	6.00	17304	0.01136	0.0146	0.00147	0.01553	10.26	4.77
3	.244	0.01504	0.00301	6.00	1140	0.00992	0.00446	0.00136	0.01429	23.70	6.34

-18 0)

(Signed) F. R. Wicks

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Plaintiffs' Exhibit No. 317.

B. & S. MINIATURE PLANT TEST.
MINERALS SEPARATION

PRODUCTS	Assays % Zn.	Recovery %
oncentrates	49.46	81.38
ailings	3.51	
rude	14.39	

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Plaintiffs' Exhibit No. 318.

ASSAYS OF HIGGINS' TESTS.
MINERALS SEPARATION

		Assay % Cu.	% Insols.
Mr. Higgins	Crude	4.64	....
Test Illustration	Concs.	14.12	17.65
of Bumping			
Table on Batea	Tails	1.27	....
—35 Mesh from Feed to			
Wilfley's Anaconda Plant			
COPPER, May 11th			
Mr. Higgins	Crude	4.64	....
Everson Test	Concs.	12.08	21.03
—35 Mesh from Feed to			
Wilfley's Anaconda Plant			
COPPER, May 11th	Tails	2.70	....
Mr. Higgins	Crude	0.51	....
Kirby Test	Concs.	1.26	36.01
Rossland Ore			
COPPER, May 11th	Tails	0.51	....
Mr. Higgins	Crude	20.68	....
Cattermole	Concs.	56.63	2.53
Test	Tails	1.99	....
BLACK ROCK			
RECEIVED 1912-13			
ZINC, May 11th			
Mr. Higgins			
Test on Solution	Crude	20.14	....
Patent	Concs.	44.86	7.25
B. H. T. ZINC	Tails	4.19	....
May 12th			

Filed May 18, 1917. GEO. W. SPROULE, Cl
By H. H. WALKER, De

The foregoing statement of the evidence and proceedings in the cause named in the caption hereof is in due time presented to the judge of this court and is approved by the judge aforesaid as true, complete and properly prepared in accordance with the stipulations made and entered into between the parties hereto.

Dated this....3........day of ~~September,~~ October 1917.

GEO. M. BOURQUIN, Judge.

Statement of evidence and proceedings filed ~~September~~ Oct 10, 1917.

GEO. W. SPROULE, Clerk,
By HARRY H. WALKER,
Deputy Clerk.

UNITED STATES OF AMERICA,
DISTRICT OF MONTANA,
COUNTY OF SILVER BOW,—ss.

I, GEORGE W. SPROULE, Clerk of the District Court of the United States, for the District of Montana, do certify and return to the honorable, the United States Circuit Court of Appeals, for the Ninth Circuit, that the foregoing record, consisting of 5793 pages, numbered from 1 to 230 and 1 to 5563, is a true and correct transcript of the pleadings, findings and conclusions of the court, decree, opinion of the court, statement of evidence and proceedings, stipulations and records therein, certificate of approval and other proceedings had in said cause and of the whole thereof, as appears from the original records filed in said court in my possession, the same being made up in accordance with the Praecipe heretofore delivered to me. And I do further certify and return that I have annexed to said transcript and included within said paging the original citation. I further certify that all exhibits have been and are herewith certified by me to be produced in court in accordance with the order of court. I further certify that the cost of the transcript of the record amounts to the sum of $2177.00, and that the same has been paid by the appellant.

IN WITNESS WHEREOF, I have hereunto set

ny hand and affixed the seal of said court, at Butte, n the District of Montana, this 5th day of November, n the year of our Lord nineteen hundred and seventeen, and of the Independence of the United States, the one hundred and forty-~~first~~. second

Geo W Sproule

Clerk of the District Court of the United States, for the District of Montana.

(Seal) By H H Walker

Deputy Clerk.

UNITED STATES DISTRICT COURT,

DISTRICT OF MONTANA.

MINERALS SEPARATION, LIMITED,
Plaintiff,

vs.

BUTTE & SUPERIOR MINING COMPANY,
LIMITED,
Defendant.

In Equity.

The examination of witnesses *de bene esse* and pursuant to order of court, beginning on the 5th day of May, 1914, on behalf of the plaintiff, before me, Harry C. Lewis, a notaary public in and for the County of the Bronx, certificate filed in the County of New York and authorized to act as a Notary Public in the County of New York, State of New York, at the office of Henry D. Williams, Esq., No. 76 Williams Street, in the County of New York and said State, in the above entitled suit.

Present :

HENRY D. WILLIAMS, ESQ., of Counsel for the Plaintiff.

THOMAS F. SHERIDAN, ESQ., and WALTER A. SCOTT, ESQ., of Counsel for Defendent.

HUGH N. LINE, a witness produced on behalf of the plaintiff, being first duly cautioned and sworn, deposes and says as follows :

DIRECT EXAMINATION BY MR. WILLIAMS :

1 Q. Please state your name, age, residence and occupation.

A. Hugh N. Line ; 41 years old ; Bartlesville, Oklahoma ; contractor for loading and unloading material for the smelters.

2 Q. And what is the material which you usually load and unload for the smeltery ?

A. Coal and ore, I unload, and clay. I load cinders and do other work for the Company.

3 Q. And what is the name of the Company ?

A. National Zinc.

4 Q. Please relate the circumstances connected with obtaining a specimen of ore or concentrate at the Bartlesville Zinc Company, near Bartlesville, Oklahoma.

A. On the 18th day of September, 1913, Mr. Gill and Mr. Jacobsen, they came where I was working and said they wanted me to do some work for them. I asked them to state the case and they told me they wanted me to secure a sample of ore from the Bartlesville Zinc Company at No. 2 Works, and they wanted a muddy slime called the Butte ore. I went and secured a sample. I was there present when the men opened the car. I went in and secured a sample. I then placed it in a bag marked " $100 "—and I believe it was the Bartlesville Union National Bank—I took it to the No. 3 office and gave it to Mr. Jacobsen and Mr. Gill. I also got the seal of the car and the number of it.

5 Q. Was the seal of the car broken in your presence ?

A. Yes.

6 Q. What is this I now hand you (hands piece of tin) ?

A. This is the seal as best I can tell, the same number ; 833,664 and " Great Northern Ry. Line," with the letter " H " on the rivet of the seal.

7 Q. What is it I now hand you (handing slip of paper to witness) ?

A. This is the number of the car and the title of it " S 15679 ".

8 Q. About how much of the material of which you took a specimen was there in the car ?

A. I would judge there was 80,000 or 100,000 pounds in the car.

9 Q. What is the No. 3 Office, to which you took this sample ?

A. That is the National Zinc Company No. 3 Office.

10 Q. When did you put this specimen in the bag?

A. In a few minutes after I procured it.

11 Q. What further happened in regard to this specimen in the bag at No. 3 Office and afterward?

A. Well, we put it in there in the bag and sealed it up and I kept it in my possession until that evening; then we went to Rowland & Talbot and there we sealed it with red and green sealing wax.

12 Q. Did you put anything else in the bag besides the specimen of muddy slime?

A. Yes, sir, put the seal of the car and the number of the car on a white slip of paper, written with a pencil. And we tied the sack with a grayish twine and the imprint of the seal on the wax was Rowland & Talbot; then I delivered it to Mr. Jacobsen.

13 Q. What is it that I now show you (hands witness a bag)?

A. That is the bag I described or one just like it. The sealing and tying is the same or just like it. The material in the bag looks like the same material, dry.

14 Q. What is the document I now show you (hands witness document)?

A. That is the affidavit I made that day, signed and sworn to by me.

Mr. Williams: The metal seal shown to the witness is marked for identification "Seal of Car," the slip of paper described as containing the number of the car is marked for identification "Memorandum of Number of Car," and the bag shown to the witness, with attached sealing and contents, is marked for identification "Defendant's Concentrate No. 2," and the affidavit shown to the witness is marked "Line First Affidavit."

Direct-examination closed.

No cross-examination.

Deposition closed.

Ernest O. Jacobsen, a witness produced on behalf of the plaintiff, being first duly cautioned and sworn, deposes and says as follows :

Direct Examination by Mr. Williams :

Q. 1. Please state your name, age, residence and occupation.

A. Ernest O. Jacobsen ; 48 years old ; living at 304 West Seventy-first street, New York City ; secretary and treasurer of the National Zinc Company.

Q. 2. Where were you on September 18, 1913 ?

A. In Bartlesville, Oklahoma.

Q. 3. Where is the plant of the Bartlesville Zinc Company ?

A. Near Bartlesville, Oklahoma.

Q. 4. Did you on that day meet Hugh N. Line, who has just testified as a witness, and what, if anything, did you ask him to do ?

A. I met Mr. Line in conjunction with Mr. Gill, superintendent of the National Zinc Company's plant near Bartlesville, Oklahoma, and requested Mr. Line to obtain, if possible, a sample of ore known as the Butte & Superior ore arriving at the works of the Bartlesville Zinc Company.

Q. 5. And what, if anything, happened in relation thereto ?

A. Mr. Line brought to me, while in the office of the National Zinc Company, a bag containing a wet substance, which he said he had obtained from a car at the Bartlesville Zinc Company's Works, and we went to the law office of Rowland & Talbot in the City of Bartlesville, where, in my presence, Mr. Line put in the bag a strip of tin and a piece of white paper, the latter being marked with the number which he said was the number of the car from which he had obtained the contents of the bag. The bag was then tied and sealed with a red and green seal and marked "Rowland & Talbot." Mr. Line thereupon gave me the bag, which I kept in my possession and brought with me to New York, delivering same to you.

6 Q. At the time that you delivered this bag and its contents to me, was or was not the bag still sealed up ?

A. The bag was still sealed up.

7 Q. When and in whose presence was the bag opened?

A. On the 25th of September, the day that I came into your office, the bag was opened in the presence of yourself, Dr. Charles F. Chandler and I think Mr. George A. Chapman was there, and myself. The contents of the bag were examined by all present, Dr. Chandler taking a sample.

8 Q. I now show you the bag which was marked for identification during the taking of the deposition of Mr. Line and the metal seal and piece of paper also so marked, and ask you whether or not they appear to be the various articles so described by you and delivered to me?

A. They do.

Direct examination closed.
No cross-examination.
Deposition closed.

Adjourned to Wednesday, May 6, 1914, at the same place, at eleven o'clock A. M.

New York, May 6, 1914.

Met pursuant to adjournment.

Present: Counsel as before.

Charles F. Chandler, a witness produced on behalf of the plaintiff, being first duly cautioned and sworn, deposes and says as follows:

Direct Examination by Mr. Williams:

1 Q. Please state your name, age, residence and occupation?

A. Charles Frederick Chandler; age, 77 years; residence, New York City; chemist by profession.

2 Q. Are you the same Charles F. Chandler who testified

as a witness for the complainants in the suit of Mineral Separation, Limited, and another, vs. James M. Hyde ?

A. I am.

3 Q. Were you in my office on September 25, 1913, and, if so, please relate the circumstances in connection with a specimen which was present on that occasion ?

A. I was present in your office on this date and, beside yourself, Mr. E. O. Jacobsen was present. A cotton bag was produced marked "$100 Silver" in red, and under that in black "Bartlesville National Bank, Bartlesville, Okla." In between the red and black descriptions above mentioned were two red lines which were very indistinct and I did not try to decipher them. The bag was tied with heavy hemp twine and sealed with red sealing wax, underneath which was dark green sealing wax. The seal covered the knot in full contact with it, and everything was intact. Just as the twine was cut by myself, Mr. George A. Chapman came in and remained to the end of the interview.

On opening the bag, a piece of white paper was found therein marked "Car No. S 15679." There was also found in the bag a narrow strip of tin plate about seven inches long and a third of an inch wide, with the following inscription in black : "Great Northern Ry. Line 833664"; and on the rivet head holding the two ends together originally appeared the letter "H."

The ore within the bag had become hardened into a solid lump. This was broken by physical force applied outside and the contents of the bag were poured out and thoroughly mixed. Half of this I took charge of and returned the other half to the bag, and tied it up as before and left it in the custody of Mr. Williams, together with the paper and strip of tin.

The moist ore, as well as the bag, had a very strong odor, apparently of an essential oil, probably eucalyptus.

This is the memorandum which I made at the time.

4 Q. What did you do with this specimen of ore that you took charge of ?

A. I took it to my laboratory at Columbia University and subjected it to chemical examination. I weighed out 150 grams of the moist ore and extracted it repeatedly with ether. On evaporating the ether in a weighed dish, there was left an oily residuum which amounted in weight to 0.24 per cent. This appeared to be a mixture of light and heavy oil and, when cold, indicated the presence of stearic acid by becoming semi-solid, stearic acid being a common constituent of commercial oleic acid. The solubility of a considerable portion of the oily material in alcohol satisfied me that a large proportion of it was commercial oleic acid. From the odor of the original ore in its moist condition, I concluded that a portion of the oily matter was probably either pine oil or eucalyptus oil, I couldn't decide which. The water in the sample amounted to 3.29 per cent., probably a little less than this in fact, because the water was determined by subtracting the joint weight of the oil recovered and the dry ore freed from oil and water from 100 per cent.; probably the oil recovered did not completely represent the oil in the sample, as the odor which I thought came from eucalyptus oil or pine oil disappeared during the evaporation of the ether, so probably the amount of oil was a little more than 0.24 per cent. and the water less than 3.29.

The following tabular statement indicates the results actually obtained from this examination :

Mineral	96.47
Water	3.29
Oil	0.24
	100.00

I subjected the mineral, after it was freed from oil and water, to a partial chemical analysis, with the following result :

Zinc	42.22	
Sulphur calculated	20.71	
Sulphide of Zinc		62.93
Copper		0.62
Residue insoluble in acids		24.57
Undetermined		11.88
		100.00

The undetermined includes iron, sulphur combined with the iron and the copper, manganese, carbon dioxide, and other substances dissolved by the acids used.

5 Q. Have you made a screen analysis of this material, and, if so, when did you make and with what results?

A. The end of April I came to Mr. Williams office and borrowed the bag of ore that I have previously described, which had been left with him for safe keeping. I took it to the University. I found it had caked together again, I crushed it with my hands so as to get it out of the bag, and then broke up the lumps in a glazed porcelain mortar, I did not triturate it; that is to say, I did not make the particles any finer than they were originally. I merely broke up the lumps so the material could be sifted. I weighed the whole and found that it amounted to 423.35 grams. I first tried it on a 80-mesh sieve and it all went through. I then sifted it on a 150-mesh sieve and 401 grams went through, leaving 22.35 grams that did not go through. Reduced to percentages, the figures are as follows:

94.72	per cent.	passed through 150-mesh sieve.
5.28	" "	did not.
100.00	" "	through 80-mesh sieve.

I then returned both these portions to the rest of the contents of the bag and thoroughly mixed them and took 100 grams of the dry powder and extracted it with ether five times in succession. The ethereal solutions were evaporated in a weighed dish and the oily product, solid at room temperature, weighed 0.1165 grams, which, of course, represents the percentage. This is considerably smaller than the residue obtained originally last September, when the material was wet and fresh, owing to the fact that the more volatile portions of the oil had evaporated in the meantime, as was the case with the water originally recovered, and probably some of the oily matter had been rendered insoluble in ether by oxidation.

6 Q. Have you anything to add as to the analysis made by you in September, 1913?

A. There were two things that didn't occur to me to mention : one was that the sample that I treated with ether last September was put in a mortar and pulverized, simply to break up the lumps which had formed by agglutinating action of the water or the oil, not for the purpose of making the particles any smaller ; and I omitted to mention the fact that last September I tested for sulphuric acid and hydrochloric acid ; I obtained a slight reaction for each, but as the blue litmus paper was not reddened, the quantity must have been extremely small or the acid must have been neutralized probably by some constituent of the ore.

7 Q. What became of the portion of the specimen which you took from my office in September, 1913, and from which you took the 150 grams specimen for chemical analysis ?

A. I returned it to you when the analysis was complete, and I now produce the bottle containing my laboratory number 4390 and marked " Original sample received from Mr. Williams, Sep. 25, 1913, C. F. Chandler,

Wt. Bottle....................	315.5 gram
" " + ORE..............	617.5
Ore	302."

8 Q. I now show you a bag marked for identification " Defendant's Concentrate No. 2 ", a strip of tin marked for identification " Seal of Car ", and a piece of white paper marked for identification " Memorandum of number of Car " and ask you if you recognize those articles ?

A. I do. They are the ones which I have mentioned at the beginning of my testimony.

" Mr. Williams : The specimen in bottle, produced by the witness, is marked for identification " Original Chandler Sample ".

9 Q. Relative to the amount of oil which you determined to be present in this material when examined by you in September, 1913, you say at the end of your answer to 4 Q. : " Probably the amount of oil was a little more than 0.24 per cent."

Can you say anything further in amplification of this statement?

A. I can only say that this was an interference which I drew from the fact that I did not detect in the oil which I extracted the delicate odor which the original ore gave off and which led me to suspect the presence of some eucalyptus or pine oil. I had no other means of forming an opinion that the oil which I weighed did not represent all the oil in the original sample.

10 Q. Could you give any representation in figures of the probable amount of oil which may have evaporated?

A. I cannot. I know it takes a very small quantity of material having a characteristic odor to display that odor. As an illustration: the odor of whiskey, brandy, rum, wine, beer is produced by small fractions of one per cent. of material; in fact, strong odors are produced by unweighable quantities of material.

Direct examination closed.

Cross-examination by Mr. Scott:

11 x-Q. The odor which was observed in the sample before extraction with ether, which odor disappeared after the evaporation with ether, simply indicated the fact that some oil disappeared without affording any indication as to how much disappeared?

A. Well, it indicated that the odor disappeared and that the substance which produced the odor probably disappeared, or else the odor of the ether employed may have masked the odor which the oil originally exhibited.

12 x-Q. There is no certain way, is there, of determining just what did happen?

A. No. Oxidation may have occurred and rendered the oil odorless.

13 x-Q. Did the oil which you finally obtained after the evaporation of the ether still have an odor of ether?

A. It did.

14 x-Q. Thus indicating that the oil was not completely freed from the ether?

A. Well, I shouldn't like to say that exactly, because there is an ethereal odor generally left in liquids extracted by means of ether. I don't think that is due to ether, but something in the ether which has this peculiar odor; some minute quantity of some foreign substance which is left behind.

15 x-Q. Did the facts observed by you, as stated in your direct examination, bear any evidence to your mind that the concentrate which you examined had ever existed in the form of what has been termed a froth or scum?

A. There were certain features which I noticed which are characteristic of material thus obtained, as a froth or scum. The first sample of material which I ever examined in connection with this subject was a sample of froth which was collected by Mr. Nutter. He put this froth into a bottle, sealed it up, sent it to Mr. Williams, and I opened it, so I had an opportunity to examine this sample of froth in its original condition, and its characteristics are precisely those of the material that was contained in the bag which has been introduced to-day as an exhibit. It was extremely fine powder, what I should think would be called slime in metallurgical language. It contained a small percentage of water, and it contained a still smaller percentage of oil. The water and oil were sufficient to cause the particles to adhere to each other to a greater or less degree, which I think would not have been the case if the material had not been a froth or scum.

16 x-Q. In what manner was the oil distributed through the mass of concentrate which was brought from Bartlesville in regard to which you have testified?

A. It was evidently uniformly distributed, for, when I examined it originally, no part of it seemed to appear differently from any other part of it; that is to say, there was no evidence of unequal distribution. It seemed to be perfectly uniform.

17 x-Q. Was the oil present in particles separate from the concentrate or was it attached to the particles of concentrate?

A. There were no oil particles visible; there was nothing to be seen but particles of mineral, and for that reason I think the oil was distributed uniformly over each particle of mineral.

18 x-Q. You have referred to certain characteristics of this concentrate which incline you to the belief that the concen-

trate once existed in the form of a froth or scum. Is this disposition of the oil as a coating over the concentrate particles one of those characteristics that have led you to the belief that this concentrate was floated as a froth or scum ?

A. I concluded that it was a froth or scum because I could not discover any difference in its appearance from the sample froth which Mr. Nutter has testified that he took from the top of a spitzkasten himself. Of course, it was impossible for me to determine whether each particle of mineral in this bag sample had a coating of oil upon it. It would be impossible to ascertain that by any observation that any one could make, but the uniformity in the appearance of the material led me to conclude that the oil was uniformly distributed throughout. If anyone had dropped oil upon a powder of this kind, wherever a drop came in contact with the powder the powder would become wet with oil and an oily spot would be visible to the eye, and it would be very difficult to distribute those drops of oil through the mass of powder so as to give it a uniform appearance.

19 x-Q. Is it your opinion that, in the concentrate as it originally existed when brought from Bartlesville, the oil was distributed as a coating upon the particles forming the concentrate?

A. It is my opinion. I don't mean to say, of course, that the different particles which were present in this mixture of different minerals were equally coated, because it is a well known fact that, when such a finely divided mass of mineral material consisting of several minerals is exposed to oil and water, some minerals such as zinc blende, have a much greater affinity for oil than other minerals, and, consequently, in such a mixture of particles the particles of zinc blende would have a larger amount of oil than the particles of some of the gangue minerals associated with it, and, of course, I am not sure that there may not be some gangue minerals which have not any oil. The philosophy of using the oil is based upon this fact that zinc blende has an affinity for oil, takes it, and then when the agitation mixes the water and ore and oil together, the zinc blende particles, being coated with oil, are entangled by the air and microscopic bubbles are produced of air enclosed in a film composed of these zinc blende particles and they come to the top as a froth or a foam. Incidentally, small quantities of the gangue minerals get entangled among these bubbles of the foam and the consequence is that this foam, when it is dried and its mineral constituents determined, is always found to contain some of the gangue material. Whether those particles of gangue were actually coated with oil or not, it is impossible to determine. They might have been brought up mechanically without being oiled.

20 x-Q. Does the determination which you made of the quantity of oil upon the Bartlesville concentrate lead you to any conclusion regarding the amount of oil which was originally applied to the entire ore ?

A. No, it does not, because I don't know how much zinc blende there was in the ore originally and I don't know how much zinc blende was left behind in the tailings.

21 x-Q. Is the particular amount of oil found upon a concentrate such as the Bartlesville concentrate one of those characteristics which you have referred to as leading you to the conclusion that the concentrate was separated as a froth or scum ?

A. Yes, it is ; such a small quantity of oil is characteristic of metallic minerals separated in the form of a foam from the original ore. I don't know of any other process that would leave so small a quantity of oil in the concentrate. At all events, I base my opinion on the comparison of this bag sample with the froth sample which I received from Mr. Nutter. There was an entire agreement in their characteristics.

Cross-examination closed.
Deposition closed.